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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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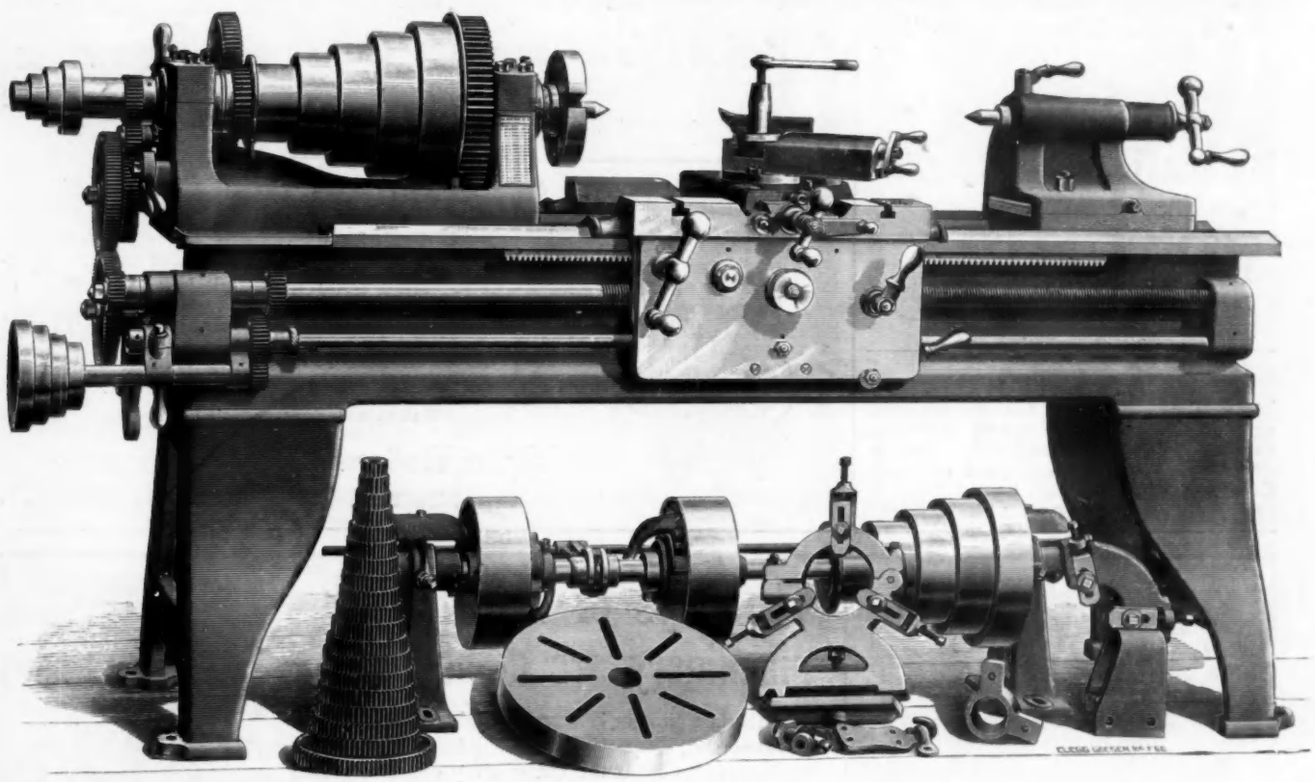

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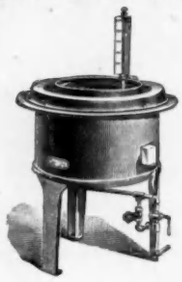

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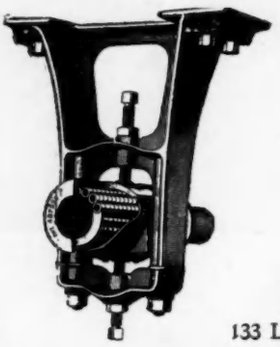

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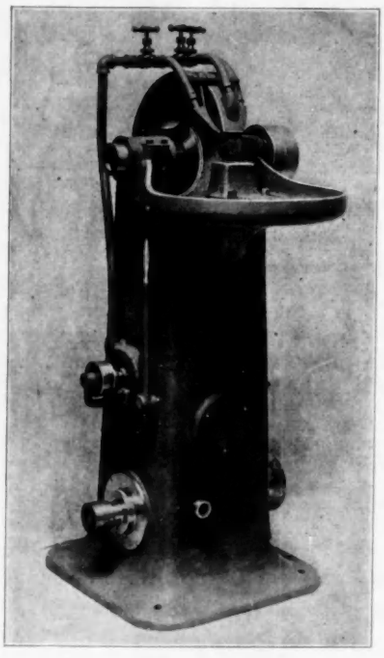

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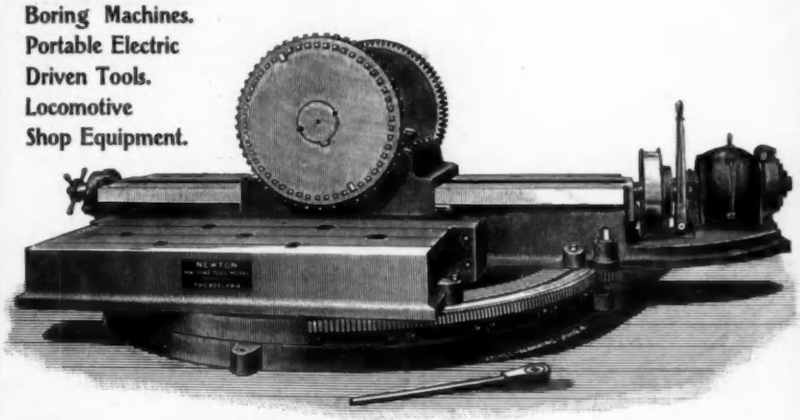

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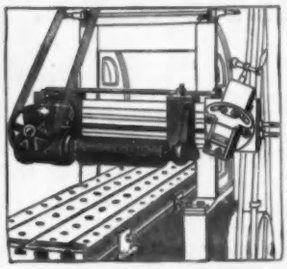

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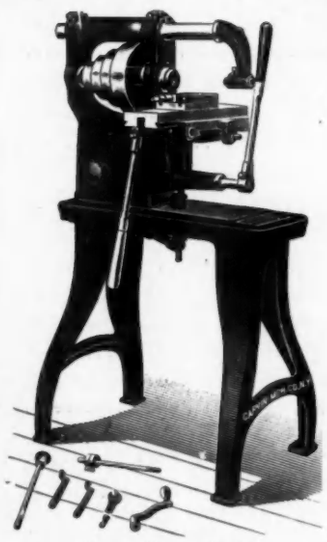

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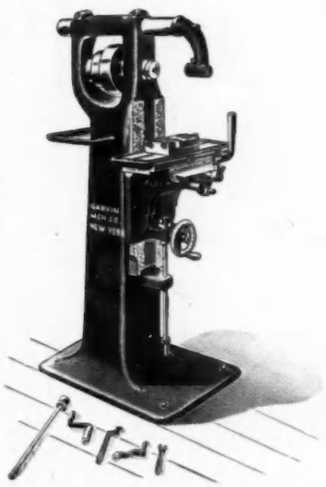

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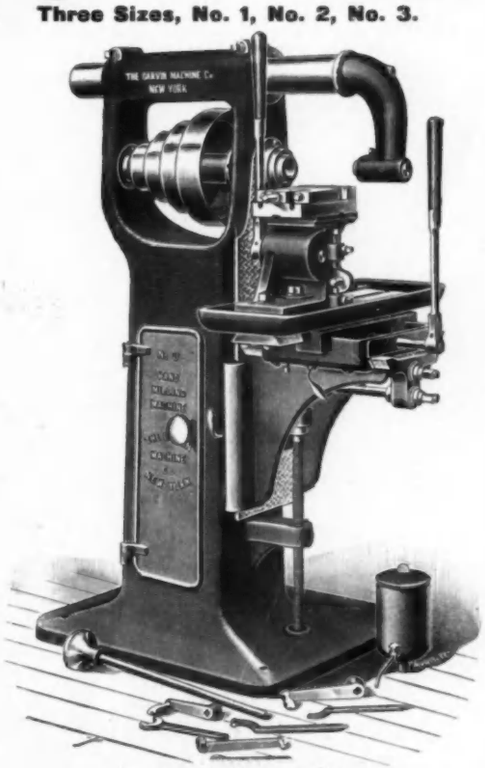

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The Fracture of Pig Iron.

Our inability to see things plainly visible, directly in our way, and having no phase of novelty, is a peculiarity of our physical and mental vision which has often been noticed and commented upon. A most striking illustration of this is afforded in the papers presented quite recently before technical societies in the United States and in Great Britain upon the worthlessness of the evidence of pig-iron fracture as to the constitution of the metal or its suitableness for any special purpose. After more than two hundred years of judging and grading, of buying and selling pig iron by fracture, it is possible to say, unchallenged and uncontradicted, as is said in the paper reproduced upon another page ot this issue, that "the fracture of pig iron is a delusion and a snare. There is not one man in ten, whether consumer or producer, that can tell by the fracture a pig iron suited for car wheels from one fit for stove plate." The evidence now seems also to be all against the chances of the tenth man knowing much more than the rest.

The occasion for reproach against the iron men, however, is not as pronounced as it appears to be. It looks singular, no doubt, that notwithstanding the experience of its unreliability, the fracture test has been retained, but the simple fact is that nothing better has been at hand. Now that we have in chemical analysis a test which may be relied upon, the fracture test must slink out of sight. It has held its own, and so much more than its own, so long because it was that or nothing. The historical paragraph at the beginning of Mr. Miller's paper should not frighten our readers away from the reading of the succeeding portions.

Annual Report of Rear Admiral Melville.

The annual report of Rear Admiral George W. Melville, Engineer in Chief of the Navy and Chief of the Bureau of Steam Engineering, has just been given to the public. The report shows that during the fiscal year ending June 30 the bureau expended $3,489,526 in connection with the machinery of naval vessels, leaving a ballance in the treasury September 1, but unavailable for current expenses, of $2,750,473. The report then, very properly, summarizes the lessons of the war as bearing on the machinery of the vessels which participated. It says:

"The general lessons from the war were in no way indicative of any desirable change in the machinery of our ships, with the exception of increasing the evaporating plants and the adoption, with all practical and economical promptness, of the water-tube type of boilers. The matter of increasing the evaporating plants has been expeditiously accomplished, and at present these individual plants on shipboard are about equal to any anticipated emergency. As regards the adoption of the water tube type of boiler, the bureau is progressing with such proper speed as is necessary to avoid mistakes and to obviate sacrifice of still useful boilers of the older type. As fast as the present outfit of Scotch boilers becomes unreliable or inefficient the new type is being substituted."

The change has been already made in the Alert, the Atlanta and the Chicago, and work on the Cincinnati and the Raleigh is in active progress.

The Steam Engineering Bureau has finally arrived at the conclusion that it is a mistaken policy to carry so far along the practice of driving the auxiliary machinery of ships by electricity, and the report presents a strong line of reasoning to support it.

The report deals with the scope of the work now done by the Bureau of Steam Engineering, which is set out in order to combat the proposition to amalgamate the construction bureaus of the Navy Department, a matter which the admiral regrets has even been speculated upon. Not only is the trend of modern mechanical work in all branches toward increased specialization, but the wisdom of it is not questioned by the leading talent in the outside world of construction work.

Admiral Melville seems to have been disappointed thus far in the practical operation of the personnel act, and expresses his inability to see indications of the benefit to the navy which was expected to result. He says:

"My belief in the spirit of the bill was that it contemplated most earnestly vast additions to the number of officers who would give earnest attention to engineering matters, and in no way imply a desire to augment the forces available for merely line or deck duty. The comprehensive union of the line and engineering vocations I still hope will be the result of the personnel charge, and I earnestly request that no departmental regulations may be formulated or permitted to exist which will in any degree tend to destroy this belief or prevent such a construction of the intention of the bill. Briefly, the fate of the reconstruction of the personnel hinges upon the provisions made for future and continuous supply of efficient engineers in the navy.

"The only plausible scheme, therefore, is to insist upon the present line officer adapting himself as soon as possible to the new conditions, and increasing, where lacking, his knowledge of mechanical engineering. Primary instruction has already been given to every graduate of the Naval Academy. Necessary practice is easily attained. Departmental regulations insisting upon alternations for the present watch officers in deck and engineer room duties will accomplish the latter end. Efficient and complete instruction at the Naval Academy will enable the future line officer even more rapidly than now to

grasp the new work and control it successfully. The practical instruction of the present watch officer, as above suggested, is a fundamental and vitally necessary feature, which, in my opinion, should govern the rulings of the department from now on."

The paper throughout bears evidence again to the earnest intent, the independence of thought and the frank and fearless honesty of its author.

The use of nickel steel in the construction of steamships is increasing considerably, and Sir William White, in delivering an address recently as president of the mechanical section of the British Association, spoke warmly of the advantages of nickel steel in ship construction. He spoke of the greater strength and rigidity of it as compared with ordinary mill steel. One thing which has operated, and is still operating, against its use for shipbuilding purposes is its high cost as compared with ordinary steel; but its use enables great economies in weight to be attained, and it has been estimated that in an ocean-going steamer of 20 knots average speed about 1,000 tons could be saved by the use of nickel steel instead of ordinary steel, which saving would suffice to raise the average speed something more than a knot, and this without varying the dimensions of the ship.

Some points are given in an article on "English Workmen and Our Own," printed elsewhere in this number, that should not be missed by those who want to be intelligent regarding the relative merits of American and other mechanics, and the conditions under which American machinery is used in foreign shops. The writer of the article spent sufficient time in foreign shops to enable him to get at the true inwardness of them, and his observations are abundantly confirmed by others who have had opportunities for studying the situation and have done so without bias.

So we are all agreed that the Shamrock is not quite as good a boat as the Columbia, and the question is, Why not? The London "Daily News," the day after the last race, put the question quite neatly, and offered, perhaps, the best of answers: "Now that it is over the Americans might tell us in a friendly sort of way how it was done. Whether they are better builders or better yachtsmen, or both, we should not be surprised to find that the American superiority lies in the national mastery of detail, which is their note also in manufacture."

Righteous Soul.—"You are bitter enough on the trusts now," spoke up a man in the audience, "but I happen to know that you belonged to one for several years." "I did, my fellow citizens!" thundered the orator. "But when I became fully awake to the enormity of the thing, I did my best to crush that trust. I sold my factories to that trust, fellow citizens, for twice what they were worth, in cash!" —Chicago Tribune.

Through a misunderstanding of the facts, the article on the "Locomotive Saddle Planing Machine," published in last week's issue, closed with the statement that the machine is in use at the Baldwin Locomotive Works. We are requested by the Newton Machine Tool Works to say that this is an error.

Messrs. David White & Co., of Glasgow, Scotland, recently constructed an 18-foot boat for service in the Klondike region, which is wholly composed of aluminum, even to the rivets, nails, bolts and nuts. It weighs but 196 pounds, and is made in sections which pack into one another and can be put into a box.

Technical Publications.

"Illustrated Catalog and General Description of Improved Machine Tools Designed and Constructed by William Sellers & Co., Incorporated." 354 7½ by 9-inch pages. Fully illustrated.

This handsomely printed and bound volume is one of the finest specimens of catalog work in existence. It is, however, much more than a catalog. In many cases the constructive features, which are characteristic of this house, and which have done much to make it famous, are presented in analytical language. Few superintendents of machine shops can look through the volume without obtaining numerous hints and suggestions for improving their equipment.

"The Automobile Magazine," Vol. 1, No. 1. 111 6¼ by 9½-inch pages. Fully illustrated. The United States Industrial Publishing Company. Subscription price per annum, $3.

This handsomely illustrated and printed magazine is of an entirely different character from what the numerous bicycle papers have come to be. Its contents are good and interesting, and in mechanical execution it is equal to any magazine printed. The bicycle press fell to its present position primarily because its field was too narrow to furnish a continuous supply of interesting matter, and we shall be interested in noting whether the editors of this magazine are more successful in this particular.

"Mechanics Applied to Engineering." By John Goodman. 605 4¾ by 7¼-inch pages, with 620 illustrations. Longmans, Green & Co. Price, $2.

This book, as its title implies, is a treatise on such portions of Analytical Mechanics as have direct application to engineering problems, and as a result of the omission of subjects of academic interest only it gives a fuller treatment of such subjects as are included than would otherwise be possible. It was not written in a closet. A book on this subject can hardly be other than decidedly mathematical, as this is, but it is nevertheless distinctly fresh and up to date, constant reference to new experimental data by the author and others being made. Many important facts are thus brought out, which, to our knowledge, have not before been incorporated in text books, being still accessible, if at all, in the proceedings of numerous scientific societies only. The discussion of the strength and elasticity of materials and structures is more complete than any we have seen, except in books devoted especially to that subject. It is, moreover, the most modern treatment of this subject that we have seen, the presentation being in the light of the latest experimental and mathematical researches. To those who are able to read it the book can be unreservedly commended, and those who are acquainted with its subject through the books of twenty years ago will be surprised at the development in the meantime.

Commercial Review.

NEW YORK, Saturday, October 28.

MACHINE TOOLS AND OTHER MATTERS.

Of vital interest to the mechanical, and to all other lines of industry, is the radical policy of the railroads in placing orders for new freight cars. The American Car and Foundry Company is reported just to have taken contracts for 21,000 cars, amounting in value to over $20,000,000, for the following roads: New York Central, Lehigh Valley, Pennsylvania, Philadelphia & Reading, Delaware & Hudson, New York, New Haven & Hartford, Missouri Pacific, Norfolk & Western. This represents but a part of the orders booked by the American Car and Foundry Company, and contracts to the amount of $5,000,000, largely from foreign countries, are stated to have been refused. The New York Central has decided to increase its capital stock $15,000,000 for the purchase of new equipment. The most important feature of this aggressive policy on the part of the railroads is its indication of their confidence in the future. It comes nearer to being a guarantee of the long continuance of the present era of prosperity than almost anything else that has occurred.

Of like significance are the contracts for 1,500,000 tons of steel rails referred to in our Pittsburgh report. The Carnegie, Pennsylvania Steel, Cambria Steel, Federal Steel and Lackawanna Iron and Steel companies have a mutual understanding as to prices of rails. In consequence, it is believed, of a notification on their part that the price would be advanced about October 25 from the prevailing rate of $33 per ton, "nearly every railroad in the

country" came in with orders just before that date. The deliveries are to be made in 1900. The price has subsequently been advanced to $35 per ton.

Demand for machine tools is still immoderately heavy and seems not in the least to be falling from the standard it has maintained through the season. "Do you see any signs of the approaching end of the boom?" was asked of a New York market authority. "We haven't yet reached the middle of it," was the reply.

The most important development in regard to prices that has taken place in some time is the action of certain manufacturers who have been noted for conservatism in their monetary system, showing a recognition that the present market conditions cannot be ignored. The Brown & Sharpe Manufacturing Company, which is one of the most thoroughly one-price firms in the machine tool line, and which up to this month had kept its prices at the level of former years, has made a definite advance. It is not an even percentage, though it is understood to be roughly from 5 to 10 per cent., and it applies to machine tools only, not to measuring instruments. The Cincinnati Milling Machine Company has lately made an advance in its prices of 5 per cent. It had not increased them hitherto. A large company in one of the Middle States, which manufactures machine tools of small and medium size, and which has hitherto made little change in figures since the boom began, is now understood to be making an advance amounting in some cases to 10 per cent., but we have received contradictory statements as to this and are not at liberty to publish details.

Middlemen are having a bonanza in these times. In cases not infrequent they have been enabled to make abnormally broad margins through the advances in prices. It often happens that after a tool is ordered by a dealer from a manufacturer, and before it is delivered, the regular price of the latter is increased. Then an alternative is presented to the dealer, whether to advance his price in conformity and make an extra profit, or to be content with the original margin, and thus undersell the contemporary market. Those whose policy in the matter has been ascertained profess to stand out for the increase, but it is complained that some are cutting the market by doing the reverse. Why anybody who has a decent tool to sell should make a concession in these times it is difficult to understand. One is reminded of the story told in the steam heating trade of a Western steamfitter who showed a boiler manufacturer his estimate on a certain job. The boiler maker noticed that no allowance had been made for pipe. "Oh, that's all right," said the steamfitter. "I have got that in the cellar and shall not have to buy it."

That dealers should advance prices when manufacturers put theirs up, and thus make any extra profits that may accrue incidentally is the more reasonable from the fact that when the manufacturers make a cut the middlemen must almost necessarily do the same, and thereby are subject to loss.

"I had a lathe in stock," says a dealer, "for which I asked $365. A man came to me and wanted to buy it. He said he had gotten one like it somewhere else for $300. That was doubtless true enough, but I saw no necessity for coming down more than $10 on my price, and was contented to keep it for some future customer."

Considering the difficulty of obtaining new tools of good size and quality within any reasonable time, it is not to be wondered that buyers are seizing with avidity upon anything in the second-hand line that may answer their purposes. Indeed, the demand for second-hand tools exceeds the supply, and the supply is much restricted because people who have tools in their shops nowadays find it expedient to use them rather than take them out and sell them.

A local house has on hand an order for an 18-inch engine lathe and a 22-inch gear cutter for Milan, Italy.

A shipment of machinery, including about 100 machine tools, will soon be made to Mr. F. W. Horne, of Japan, who is now in this country. It is for a railroad machine shop.

A quantity of metal working machinery estimated at $17,000 in value was shipped Saturday last on the steamer La Gascogne to the factory of an automobile company which is being equipped near Paris, France.

The awards of contracts for the machine tool equipment of the steam engineering machine shop of the New York Navy Yard, based on bids opened October 10, have not yet been made, and probably some little time will elapse before they are decided upon. It is reported that unusual pains will be taken in making a selection, and that the matter will first be referred to a board who will visit the various shops where the tools bid upon are manufactured, in order to obtain closer information as to the character of work done. Chief Engineers John A. B. Smith and James H. Perry are talked of as members of this board.

We mentioned a few months ago that the American Tool Works Company, Cincinnati, had in contemplation to erect large new works and to extend their lines of manufacture, particularly as regards heavy tools. Information is received from reliable sources that the project has so far matured that the company has secured 25 acres of land at Cincinnati as a site; that the designing of the works will now be begun, and that their construction will follow in sequence. It is said that machine tools of greatly varied character will be manufactured at the new plant.

Mr. Rudolf Kirschbaum, manager of the German Garvin Machine Company, who is now in this country, has purchased the plant of the Warren Machine Company, Worcester, Mass., manufacturers of radial drills. It is said that the plant will be enlarged and will be maintained in this country for the manufacture of goods for the domestic as well as the foreign markets.

The Harrisburg Foundry and Machine Works, engine builders, are now occupying their new plant, the contemplated erection of which was long ago announced in these columns. It was the intention when these works were started to abandon the old ones upon their completion. The heavy demand for engines that has arisen in the meantime has occasioned a change of plans in this particular, so that now both shops are being run 23 hours a day, and in addition four outside establishments are employed in work for the company. The operation of both old and new shops is necessitating the purchase of a good many additional tools, and besides those already installed some good-sized orders are now outstanding. We should judge from what we learn in this market that upwards of $25,000 worth of tools have been ordered within a comparatively few weeks. The company is now building some large engine units, one of which is a belted four-valve accelerated cut-off engine for mill purposes at Haverhill, Mass., but the orders on hand make it necessary to let much new work slip by. An advance in prices is expected to be made by the company November 1.

The McCormick Harvesting Machine Company, Chicago, is fitting up a new shop, and is buying a large valuation of tools therefor. The company has the reputation of being a large buyer of tools at all times, its orders with one house coming in nearly every month.

A certain manufacturer of large tools has refused to accept an order for a 30-inch lathe for delivery within a year.

The Dietz Machine Tool Company, Cincinnati, was incorporated at Columbus, Ohio, October 24, capital $25,000, by Messrs. J. Dietz, W. Lodge, M. Shipley, Jr., F. A. Lamping and L. J. Dolle. It has already been mentioned that Mr. Dietz had withdrawn from the firm of Dietz, Schumacher & Boyce to build a new shop. It is said that this new concern will manufacture machine tools under contract for the Lodge & Shipley Machine Tool Company.

The United Railway and Electric Company, of Baltimore, has let contracts for the construction of car sheds, a repair department, etc., including a machine shop, for which, presumably, they will soon need a machine tool equipment.

The American Match Machine Company was incorporated at Trenton a few weeks ago, with a capital of $1,000,000, and has purchased from a Mr. Ferguson, of New York, a plant at Bound Brook, N. J., for the manufacture of match and match-box machinery. They are booking a good volume of orders, and expect to make some improvements in their equipment.

There is prospect that the fight for electrical machinery contracts between the Westinghouse and Walker companies, which, just when it got to be interesting was terminated in this country by the union of the two concerns, will be repeated on British soil. The Walker patents, which were held by that company by assignment from various engineers in its employ, passed over to the Westinghouse company so far as the American rights were concerned, but the English rights were secured by Dick, Kerr & Co., the firm which is erecting large new works with an equipment of American machine tools at Preston, near Liverpool. This firm has a capital of $1,750,000, and may prove no insignificant competitor of the British Westinghouse works now going up at Manchester.

The Ames Iron Works are loaded up to fullest capacity with orders. A contract is now on hand for 620 horse-power of return tubular boilers for Borden's Condensed Milk Company, Norwich, N. Y.

PITTSBURGH REPORT.

The wind-up of the month of October shows trade to be in a very good condition. Pig iron stiffened up a little, there being total sales of 100,000 tons of Bessemer pig iron during the last week at $23 and $23.50 per ton, Valleys, with a corresponding advance in Pittsburgh. For small lots the rate has been as high as $25.25. The deliveries allowed for the large sales extended over the first six months of 1899, and it is certain no contracts will be taken for delivery earlier than next May, and these will not be for large lots. There is not the slightest tendency towards a weakening in prices; in fact it is almost certain that prices, in some lines, will be higher before many weeks.

During the last of the month most of the railroads which were in the market for rails came together and bought 1,500,000 tons of steel rails, the total cost of which footed up to nearly $50,000,000. To fill these orders it will take one-sixth of the entire output of steel for 1900. This does not include the Russian Government contract which was taken some time ago, together with other orders, which will make the aggregate tonnage in rails next year more than has already been ordered. Great as the demand will undoubtedly be during 1900, the supply will keep closer to it than during the earlier months of this year.

Foundries are rushed to the utmost. Large rolling-mill owners who have heretofore been ordering their general line of machinery from large machine builders have been compelled to go to some of the smaller people to get machines. This is the season of seasons for the small machine shop, as well as the owner of a foundry where castings down to a pound can be furnished. One can still hear of a concern that is well filled with orders, but which is still working off orders taken a year or so ago when prices were in a rut. But they are getting scarcer each day, and are looking for a near future when they can realize better profits.

The Union Steel Company, which has been organized by W. H. Donner, who for some years past has been connected with the iron and steel trade, Mellon Brothers and others, of this city, will erect a large plant near this city. It will comprise a blast furnace, rod mill, Bessemer plant, etc., and will be complete in every respect. Contracts for engines have already been awarded to the Southwark Foundry and Machine Company, Philadelphia, Pa., while the contract for several of the buildings has been given to the Shiffler Bridge Company, Pittsburgh. The concern is endeavoring to secure a location up the Monongahela Valley, which offers abundance of fuel, good shipping facilities and every accommodation necessary for a large plant. Mr. W. H. Donner is looking after the wants of the new company, and has established offices in the Carnegie Building, Pittsburgh. The Schoen Pressed Steel Car Company has secured additional property in Allegheny and will likely add to its plant in that place. The Pittsburgh Sheet Manufacturing Company has in contemplation the erection of additional buildings to take care of its rapidly growing trade. New machinery will be installed.

CHICAGO MACHINERY MARKET.

Satisfactory is the continued state of the machinery trade in the West. The volume of business in machine tools shows no diminution from the high-water marks recently imposed. Some houses report trade rather less in volume than in August and September. Others find totals reaching an altitude never before attained. Not so long ago a $5,000 inquiry was enough to induce a most active scramble for the business and a cutting of prices down dangerously close to cost. Now a $5,000 order is an ordinary occurrence. Within the past few days the Chicago & Northwestern Road bought tools to the value of about $20,000. The McCormick, Deering and Plano implement people have all been generously in the market, and one order of one of them last week was for about $20,000 worth of machinery. There is considerable business in sight for the near future. It is widely scattered, coming in large quantities from points as distant as Denver, Colo., where the machinery trade is described as very active. The Colorado Fuel and Iron Company is one of the largest inquirers for tools, but there are many others. Mining operations are untrammeled by financial considerations, and machine shop work is in abundance. The railways are buried beneath the business that is offered them, and some important expansions in their shop facilities are not far distant. It is impossible to localize or differentiate the business in machine tools that is current. It comes from everywhere. Much of it is to replace tools in a fair state of preservation. Not uncommonly an increase of 10 to 20 per cent. in efficiency can be attained by discarding a machine that is ten years old and replacing with one of recent manufacture, and the number of plants which can profitably make this kind of substitution is legion. The old tools often go to scrap, but sometimes find their way to a country shop where a high grade of efficiency is not indispensable.

Prices are slowly moving upward, though many makers have not advanced goods during the past month. Deliveries are likewise improving slightly in the aggregate, perhaps, but there is continued complaint at the slowness of shipment. Planers continue especially scarce.

The business of the Marshall & Huschart Machinery Company exceeded any previous month within their history. Hill, Clarke & Co. and McDowell, Stocker & Co. also report for October the best month they have ever had. Rudolphi & Krummel are having a big trade in both presses and sheet metal and wire-working machinery. The Standard Thermometer Company, of Peabody, Mass., has opened a branch factory in Chicago.

Quotations.

NEW YORK, Monday, October 30.

Iron—American Pig, tidewater delivery in 1900:—

Pennsylvania Irons:	
No. 1 X foundry	$23 85 @ 24 60
No. 2 X foundry	22 85 @ 24 00
No. 2 plain	21 60 @ 23 00
Alabama Irons:	
No. 1 foundry	22 75 @ 23 75
No. 2 foundry	21 75 @ 22 75
No. 3 foundry	21 00 @ 21 50
No. 1 soft	22 75 @ 23 75
No. 2 soft	21 75 @ 22 75
Foundry forge	20 50 @ 20 75

Bar Iron — Base sizes — Refined, mill price on dock, 2.20 @ 2.35c.; store price, 2.60c., upward; common from store, 2.50 @ 2.60c.

Tool Steel—Base sizes, Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 3c. in small lots.

Cold Rolled Steel Shafting—Base sizes—From store, 4c. in small lots.

Copper—For Lake Superior ingot, 17 @ 17¼c.; electrolytic, 16⅞ @ 17c.; casting copper, 16⅞ @ 17c. Higher prices are still asked in some quarters.

Pig Lead—Carloads, 4.62½ @ 4.65c.; wholesale lots, 4.60c.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 31 @ 31⅜c.

Spelter—Prime Western in carload lots, 5 @ 5¼c.

Antimony—In cask lots or over, Cookson's, 11 @ 11¼c.; Hallett's, 9¾ @ 9⅞c.

Lard Oil—Prime City, present make, ice-pressed, 45 @ 46 c. in jobbing lots.

A Proposed Improved System of Hydraulic Piping—I.

BY WALTER FERRIS.

A few years of experience of the good and evil of hydraulic power transmission have made me do some thinking on the subject, the net result of which is that I have thought out a scheme of arrangement for such plants that seems to me worth considering. There is perhaps no better way of getting it considered than by submitting it to the readers of this paper for their gentle criticism. As yet I have not been able to make a complete trial of the system, and if any of the readers have done any experimenting on the lines which I shall presently describe, it would gratify me to hear from them, directly or through these columns.

In order to bring clearly to mind the objects of the proposed changes, let us review the nature of the ordinary plant, and of the troubles encountered in operating and maintaining it.

Such a plant usually consists of a line or lines of piping, frequently traversing a large area, and filled with water under high pressure. The water is thus led to the various machines to be operated, where it is used as a motive power, to be drawn upon at any instant, very rapidly and very irregularly. At some central point in the system is located a pump, the duty of which is to force into the system as much water as is drawn out, and keep up the pressure. It is impossible for this pump to respond instantly to the demand upon it and replace exactly the amount of water used; and it is equally impossible to proportion the pump to deliver the water at a fixed pressure. Hence an accumulator is used, consisting simply of a vertical cylinder and its plunger, the bottom of the cylinder communicating with the pressure main and the pump plunger, and so loaded with weights that the water in the system must have the desired pressure before the plunger will rise. When lifted, it rises and falls with variations in the quantity of water contained in the system, and is connected to the throttle valve in the steam pipe of the pump, so that before the accumulator plunger reaches the top of its travel the pump is stopped, and is started again when the accumulator plunger begins to descend. As the accumulator is always loaded with the same weight, it is supposed to keep the pressure in the pipes approximately constant, and at the same time it acts as a reservoir. A complete working drawing of such an accumulator is given in the "American Machinist" for October 27, 1898, in connection with a description of the hydraulic plant of the Pope Tube Company.

In addition to the pressure system proper, as outlined above, large plants are usually provided with a corresponding system of return pipes, through which the exhaust water is taken back to the pump, to be again forced into the pressure system. This is partly for economy of water, and partly to avoid, as far as possible, the introduction of fresh gritty water into the system, thus preventing a large part of the cutting out of packing.

Such a hydraulic plant, if good workmanship and proper materials are used throughout, is a practical success. Nevertheless, it is subject to violent fluctuations of pressure, due to the inertia and friction of water in the pipes. The resulting deterioration of packings and machinery is, I think, considerable, beside the more important loss due to the uncertainty which the designer of hydraulic machinery feels about the available pressure. This results in a material increase of size in the plungers. If he knows that the nominal pressure of 500 pounds is subject at all times to a fall of 50, or perhaps in some cases even 100, pounds, all the machinery must be made with cylinders 10 to 20 per cent. larger than would be needed if the nominal pressure were maintained. Some experiments made by the writer ("American Machinist," February 3, 1898) seem to show that this is greater than the whole loss necessarily due to friction of packing.

Another cause of pressure fluctuations is the inertia of rapidly moving accumulators, and a good example of the extent to which this may operate under favorable conditions is given by the hydraulic riveter plant shown in Fig. 1. In this case the pump and accumulator have only to drive one machine, a 100-ton hydraulic riveter, with a piston 14 inches diameter. The capacity of the riveter cylinder is nearly equal to that of the accumulator, and the latter falls nearly to the bottom of its stroke when a rivet is driven, causing the pump to start very suddenly. To reduce the shock on the pipe, an elastic resistance was introduced between the pump and the accumulator, in the form of a spring buffer, as shown in the figure. It consists of a 1¾-inch plunger introduced through a stuffing box into the pressure pipe; the outward movement of the plunger being resisted by a heavy spring. This does not appear to accomplish its object to any great extent, as it moves very little when the pump is working fast and the accumulator nearly stationary.

Referring to Fig. 1, it will be noticed that the accumulator ram is only 6 inches diameter, while the riveter cylinder is 14 inches. Hence, the accumulator moves 5.4 times as fast as the riveter ram, or probably at about 5 feet per second. Moreover, the connection to the 2-inch main at the base of the accumulator is only 1-inch pipe, "double extra" heavy, so that the water in this connection must move 6.6 times as fast as in the main (the internal diameters are 1.49 inches and .58 inch).

In this case, it is not necessary to figure out results, for the spring buffer acts as a very good indicator of the pressures in the pipe. When the valve of the riveter is suddenly opened, the accumulator falls, and at the same time the plunger in the spring buffer is pushed inward by its spring a distance of ⅛ to 3-16 inch, according to the suddenness of the operation. When at rest this plunger is raised about 1 inch by a pressure of about 1,300 pounds per square inch in the system. This inward movement therefore indicates a fall of pressure of 160 to 240 pounds per square inch during the descent of the accumulator, due partly to the velocity of water in the main, but chiefly to the inability of the accumulator to keep up the pressure in a 2-inch pipe by forcing out water through a 1-inch connection. When the riveter completes its stroke, the buffer plunger is forced outward ⅛ inch, or 3-16 inch beyond its neutral position, showing a rise of pressure of 160 to 240 pounds above the normal. It then immediately settles back to its normal position.

From this we see that, notwithstanding the accumulator connection is choked so much that it cannot maintain the pressure within 18 per cent. of the normal, its mass acquires sufficient kinetic energy during the fall to raise the pressure that much above normal when its velocity is checked.

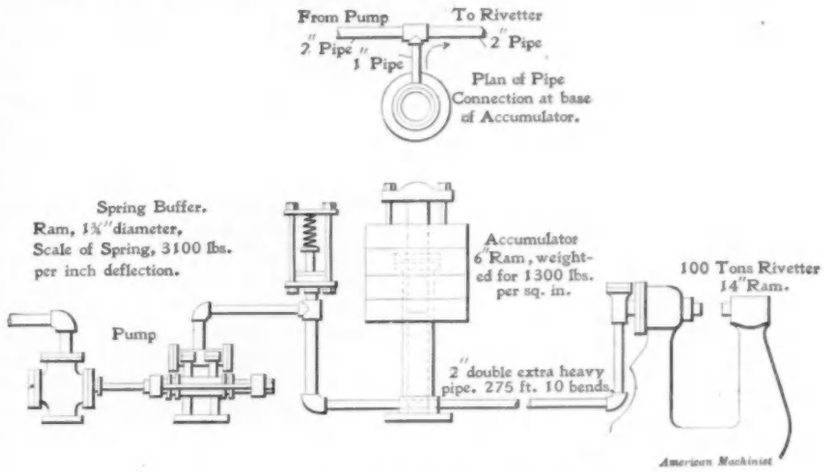
From Pump
2" Pipe
1" Pipe
To Rivetter
2" Pipe
Plan of Pipe Connection at base of Accumulator.
Spring Buffer.
Ram, 1¾" diameter,
Scale of Spring, 3100 lbs. per inch deflection.
Accumulator 6" Ram, weighted for 1300 lbs. per sq. in.
100 Tons Rivetter 14" Ram.
Pump
2" double extra heavy pipe. 275 ft. 10 bends.
American Machinist

FIG. 1. SPRING BUFFER APPLIED TO A HYDRAULIC PLANT.

If the connection were larger the pressure would be better maintained, and the accumulator would drop more rapidly, and the rise of pressure at the end of stroke probably greater. In this case it would possibly be greater than the pipe could stand continuously, and the plant is consequently modified to an extent which seriously impairs its efficiency.

A similar set of difficulties will be found to exist in most return-pipe systems, which conduct the exhaust water back to the pump. In these pipes, of course, the pressure should be uniformly as low as possible. In practice, very high back pressures often exist, due to two causes which should be considered separately; these may be termed gorging and shock. The first is merely the result of a return pipe too small for the combined demands of several machines operating at once. Its effect is merely a high back pressure, and resulting loss due to stoppage of machines, usually without damage to the piping. Shock is of course merely the result of a sudden gorging, due to the quick release of a large quantity of water, which causes severe hammering by striking bends in the exhaust pipe, and often damages pipes which would be large enough if a little more time were allowed. I mention this trouble separately because its remedy is special—a pipe large enough to stop all shock is hard to put in. In one case in my experience (the riveter plant of Fig. 1) the exhaust pipe was split repeatedly, until an air chamber of 8-inch pipe, about 4 feet high, was placed close to the cylinder to receive the first rush of water and allow it to flow back toward the pump gradually. This pipe has not given the slightest trouble since. The air chamber does not become water-logged, and requires no attention whatever.

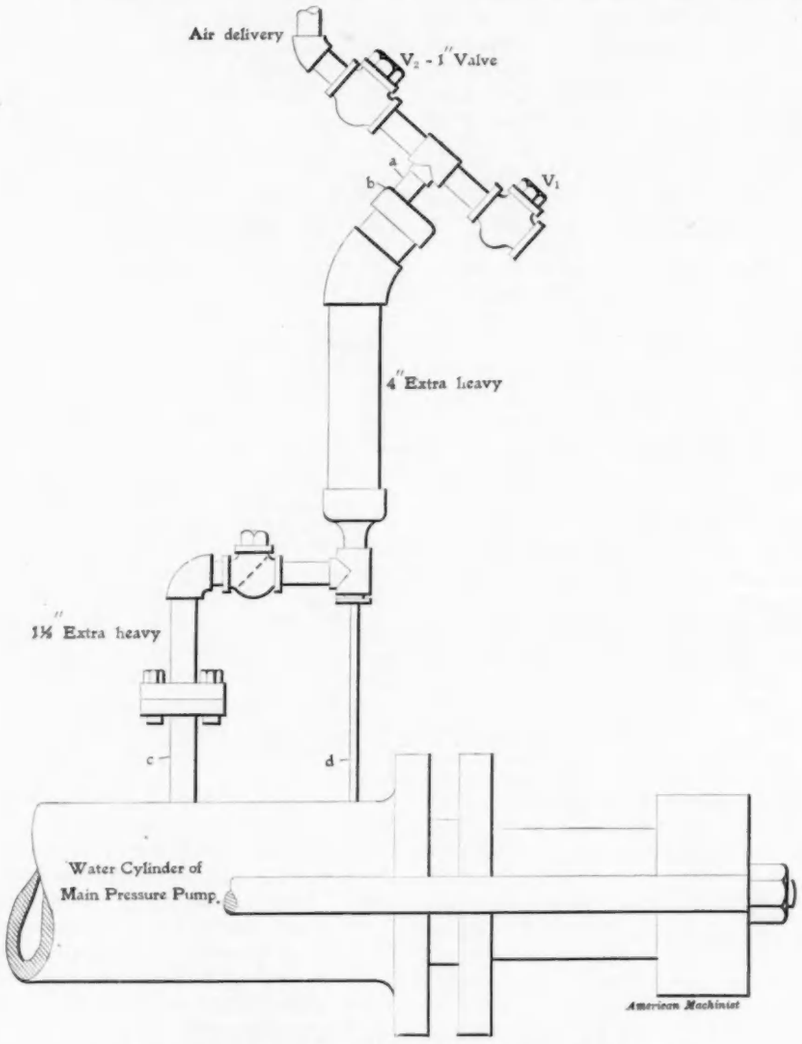

FIG. 2. AIR CHAMBER CHARGING PUMP FOR HIGH PRESSURES.

I think the extent of the back pressure existing in growing plants is often unsuspected. Most of my personal knowledge refers to the different parts of one large system. In nearly all instances the back pressure is considerable, and rises temporarily to 150 pounds or more when three or four machines are operating at once. This is on a 500-pound system. During most of the time the back pressure was from 20 to 40 pounds, but it is obvious that the temporary rises to much higher figures are the ones that cause loss by stoppage of machinery at critical moments, while the steady lower pressure shows in the average cost of operation. These high back pressures are very likely to exist at the same time with a drop of 50 pounds in the pressure system. It is evident that an additional machine starting at this instant can exert less than 60 per cent. of its nominal force. This, as already stated, makes excessively large cylinders necessary, and this very remedy makes the trouble worse. Evidently, the only real remedy is a close maintenance of the nominal pressure of the system, and avoidance of back pressures.

How shall this be done? The authorities say by large pipes. I think this is impracticable, and a strong indication of this is, that while every engineer knows the remedy, it is not applied. The continual replacing and altering of mains would be so expensive—in a growing plant, the direction of whose growth cannot be exactly predicted—that it is usual to run at low efficiency, taxing existing mains to their utmost capacity, before incurring the expense of enlargement. It seems to me that the real trouble lies in the lack of compressibility in the medium used to transmit hydraulic pressures. The whole system is designed to be perfectly inelastic, when it would be more desirable to have it divided into a series of inelastic units connected by large volumes of highly compressible material—that is, air.

As a remedy for the defects of hydraulic power systems I propose to introduce elastic resistance at intervals along the pressure and return mains, and thereby convert the system from a practically inelastic to a very elastic one. This elastic resistance is the familiar air chamber, specially proportioned to suit the conditions, and supplied with air by a special device, to make up the loss from absorption by water. Each of these air chambers is to be in effect an air and water reservoir, containing enough water to supply sudden drafts from the machines in the neighborhood and enough compressed air to expel this water on demand, with a fall of pressure within a limit of, say, 5 per cent. of the average working pressure of the system. When this water is withdrawn the pressure falls, and in consequence water from the main immediately flows into the depleted reservoir, until the body of air is again compressed to the accumulator pressure.

With this outline as a preface, the operation of the system can perhaps best be understood through a description and illustration of its details. These consist of air pump, air chambers, air supply pipe from air pump to one air chamber, from this to the next, and so on around the whole series, and the peculiar arrangement of these parts to accomplish the desired results.

Air Pump.—This may be any kind of

an air compressor that will deliver air at the pressure required. The quantity used will be small, but I can give no accurate data. The amount to be supplied is what the water surface in the set of from one to ten or more large air chambers will absorb. Besides this, when the plant is being started up with the mains empty, all the air chambers will be full of water, and the working will not be satisfactory until the air pump has filled them with air in the manner to be described.

For all but the largest plants a water piston air pump, similar to the one described in my article in the "American Machinist" for March 30, 1899, will be quite sufficient; and even where it is desirable to have a special compressor for use in starting the plant the little water piston pump will be more economical and satisfactory to maintain the air supply. The design of this form of pump for high pressure work is shown in Fig. 2. It consists merely of a vertical barrel of pipe, connected at the bottom with *one* water cylinder of the main pressure pump, and ending at the top in a branch carrying two check valves, one inward and one outward opening. The connection to the main pressure pump is preferably—though not necessarily—double; a large pipe with a check valve opening toward the main pump, and a small pipe without a check valve. This is to partially equalize the amount of water passing from the main pump to the air pump under (say) 500 pounds pressure per square inch with the amount returning to the main pump during its suction stroke, at a pressure of 5 or 10 pounds. Hence, during the suction stroke the water from the air pump comes into the main pump through both the 1½-inch and ½-inch pipes, but it is expelled during the delivery stroke through the ½-inch pipe only, as the check valve in the 1½-inch pipe closes. It is absolutely necessary to the successful working of this pump that it should have *no* appreciable clearance spaces. During the delivery stroke of the main pump the water must rise into the air pump and fill it up to the upper check valve V_2, expelling every particle of air. Some water goes through the check valve, too, but that does no harm. Then, during the suction stroke the valve V_2 closes, the water is drawn back to the main pump, followed by air which enters through the check valve V_1, and which is expelled during the next delivery stroke. The branch carrying the two check valves V_1 and V_2 is inclined, in order to prevent the trapping of air under the caps of the valves or in other recesses. For the same reason the nipple *a* is tapped into the cap *b* at the highest point. In proportioning the pipes *c* and *d* it is also necessary to be sure that more water will leave the main pump during each delivery stroke than will come back during the next suction stroke. Otherwise the barrel of the air pump will soon be pumped dry and fail to work. It is hardly necessary to remark that the first cost of this pump is very low, and repairs slight.

Pig-Iron Fractures and Their Value in Foundry Practice.*

BY MR. JAMES WILLIARD MILLER.

In a paper entitled "The Yard Grading of Pig Iron," read in December, 1898, before the Foundrymen's Association of Pittsburgh, Dr. William B. Phillips, editor of the "American Manufacturer and Iron World," and one of the best-known chemists in America, gives a curious account of the present method of grading pig iron. Of course, like many of the good things in the iron and steel world, the method of grading pig iron originated in Great Britain several hundred years ago. Dud Dudley, in his petition to King Charles I. in 1660, on the subject of the manufacture of pig iron, states that there were then made three kinds of iron, to wit, in the original words: "The first sort is Gray Iron, the second sort is called Motley Iron, of which one part of the Sowes of Piggs is gray, the other part is white intermixt; the third sort is called White Iron; this is almost as white as Bell Mettle, but in the Furnace is least fined, and the most terrestrial." The author goes on to say, "I may take occasion here to speak of the Nature of Coldshare Iron, which is so brittle, if made of the grain Oare or Ironstone, would be almost as brittle as some Regulus Antimonii made Iron, for with one small blow over an Anvil you may break the biggest Bar that is, if it be perfect coldshare Iron—nay, the ploughman often breaks his Sharepoint off if it be made of coldshare Iron. But perfect tough malliable Iron will not break feasibly in hot-heat or cold, as coldshare will, or red-hot as Sulphurious veneriated redshare Iron will, but yet tough enough when it is cold. All of which aforesaid qualities of Iron the Authour well knoweth how to mend their Natures, by finning or setting the finery lesse transhaw more burrow, which are terms of art, and by altering and pitching the works and plates, the fore-spirit plat, the tuiron, bottome, back, and breast or foreplate, by the altering of which much may be done, if the work be set transhaw and transiring from the blast, the Iron is more coldshare lesse Fined, more to the Master's profit; lesse profitable to him that makes it into manufactorage, and lesse profitable to him that useth it, but the Iron made in a Burrow work becometh more tough and serviceable; yet the nature of all Ironstone is to be considered, both in the Furnace and in the finery, that the Sulphurious Arcenical and Veneriating qualities, which are often times in Ironstone, be made to separate in both the works from the fixed and fixing bodies of iron, whose fiery quality is such that he will sooner self-calsine than separate from any Sulphurious veneriated quality."

This is the earliest recorded attempt to grade pig iron in the yard, and passed as the most scientific description that had yet appeared. Since that date we have drawn away from the arsenical veneriating quality of pig iron, and have substituted cold-short for cold-share iron, but in other respects the description might be used today. If the spirit of Dud Dudley could make the rounds with a pig-iron breaker and grader, he would feel perfectly at home, and would rejoice that the art which he founded 240 years ago had not progressed much beyond its original lines.

Dud Dudley was satisfied with three grades of iron, whereas six grades are now universally recognized, which, however, cover the ground but little better than did Dud Dudley's three grades—in fact, not so well. In the youngest district in America, where now about 30 per cent. of all the foundry iron in the United States is made, thirteen distinct grades have been established, still leaving room for more.

The grader, in conscientious sorting of the iron into its different grades, ever and anon runs against a fracture that fits neither grade so far established; hence a temptation to form a new one.

In the beginning of ironmaking in the district referred to, Alabama, before the nature and condition of the ore and fuel became understood and regulated, the furnaces working under unsettled conditions, operated by green hands from the cotton fields of Alabama, and directed in many cases by inexperienced managers, who would probably set the blast too much "transiring" or not enough "transhaw," produced iron which would not fit into any of the six existing grades. The conscientious grader, to cover the ground, therefore, added four more regular grades to the six existing, viz., No. 1 silvery, No. 2 silvery, No. 1 soft, No. 2 soft, making ten in all, and still the ground was not satisfactorily covered. No. 4 foundry had to fill the gap between gray forge and No. 3 foundry, caused by the decreasing demand for puddled iron, and to cover the ground more thoroughly, the grades of No. 1 X, No. 2 X and No. 3 X were inserted between the regular numbers, making fourteen grades in all, with which the manufacturer is burdened, by which the consumer is confused, and over which both wrangle, and which never was a true measure of quality, and therefore never can be a satisfactory one.

The fracture of pig iron is a delusion and a snare. There is not one man in ten, whether consumer or producer, that can tell by the fracture a pig of iron suited for car wheels from one fit for stove plates. Where is the line of demarcation between succeeding grades? What is the difference between an open No. 3 and a close

* Paper read before the Iron and Steel Institute of Great Britain.

No. 2, for example? No matter how carefully the grading is done, there must be, by the very nature of things, in every grade some pigs closer than others. There is, therefore, always room for contention, even when both sides are trying to be fair, which is not always the case.

Mr. E. A. Uehling, in a paper read before the Foundrymen's Association at Pittsburgh, gives the following experience due to these facts:

A lot of No. 2 iron was shipped to a consumer. When the date of settlement came, instead of the proper remittance, there came a long letter of complaint stating that the iron was not up to grade; that fully 50 per cent. of it would not go better than No. 3, and that a reduction in price must be made on the iron equal to the difference in the market value between the grade sold and that actually shipped, viz., 50 cents a ton.

The case was worth investigating. When the furnace representative arrived, he found a lot of samples of the iron in the office awaiting his inspection. The iron was from the lot, there was no doubt of that, and the grade was not better than an open No. 3. He knew that straight No. 2 had been shipped. So closer investigation was necessary. He went to the pig-iron yard. The attendant furnished by the customer broke a lot more of the half pigs with the same result—an open No. 3 at best. But the furnace representative happened to be equal to the occasion. He helped himself to some of the iron and broke it, and to the pretended great surprise of the purchaser, nearly every pig showed a fracture much nearer No. 1 than No. 2, and the iron was accepted as sold.

As another instance of the loss sustained by the manufacturer of pig iron owing to the present method of grading iron by fracture, I will take sufficient of your time to give you briefly the story of a concern at present doing business in the United States in the manufacture of car wheels. It is one of the largest in the United States, and its whole business has been based upon, and its wonderful success is owing to, the fact that its competitors insisted on buying pig iron by fracture, and making their mixtures from that basis; whereas the concern I speak of buys its pig iron irrespective of fracture, except as it regulates the price, making up its mixtures for its castings wholly by chemical analysis. Some years ago this concern started with a small capital in the manufacture of car wheels. The organizer of the company realized the fallacy of depending on fracture as a measure of value, and taking fracture as the basis for the quality of the car wheels made from it. He went to the manufacturers of foundry iron and bought what was considered by his competitors, because of fracture, the lower grades of foundry and even forge iron. He bought this class of iron at comparatively low prices, and had it brought to his foundries—of which there are several, located at different points—at one of which I personally know he smelts over 100 tons a day. There the chemist begins his work. He analyzes each lot, and from the so-called low-grade irons calculates the mixtures from which the car wheels are made, which to-day practically control the trade in the United States. This is only one of the many instances illustrating what chemistry can do in the foundry, and it is rather astonishing that so many foundrymen still go on in the old way, losing sight of their own interests, making trouble for themselves, as well as the producers of pig iron, without any compensating benefit, adhering to the method of Dud Dudley, setting the blast "transhaw" and "transiring" to overcome the irregularities born of unreliability of the fracture as a measure of the quality and character of the iron used.

The fact is that nearly every pig of iron varies in grade from one end to the other. Not infrequently you can show up three distinct grades in one and the same pig. The sow, if at all heavy, is invariably from half to a whole grade higher than its pigs. Is the iron in the sow therefore of a better quality? This is hardly reasonable; yet there is a difference in price from 1s. to 3s. The value of an iron, therefore, does not depend upon its fracture, nor is the fracture any guide as to the special purpose for which a certain iron may be best suited. It is only an indication of the condition of the furnace that produced it, and not an altogether trustworthy indication of even that. The principal factor that determines the grain in the fracture of cast iron is the time given it to pass from the liquid to the solid state. No one is better aware of this fact than the foundryman.

Of two castings poured from the same ladle, the lighter casting is invariably the closest grained. The degree of hardness resulting in a casting is not determined by the fracture of the pig iron, but entirely by its chemical composition and the rate of cooling. No. 1 iron may be fitted for car wheels, or it may be suited for stove-plates, or it may be useless for either. How many can tell what it is suited for by the fracture? No. 1 iron may contain anywhere from ½ to 3½ per cent. of silicon, and the other elements, with the exception of carbon, may vary in the same proportion. Experience has taught the practical foundryman that certain brands of iron are best suited for a certain class of work. He ascertains this by trying first one and then the other, and then several brands in combination in varying proportions, until he gets the right thing. When he has it he sticks to it. Everything goes smoothly for a while, but suddenly something gets wrong. The castings come out hard or lack strength; have too much shrinkage; are full of blow-holes, cold-shots, and what not. What is the trouble? The same brands, the same grades, the same mixture. No change at all; yet there must be something the matter with the pig iron, and it must be in that last shipment, of course. There was no trouble until it was put on.

It is thoroughly investigated, and sure enough, the lot contains pigs with close edges, others with dense spots, and more with irregular grain. The iron is not up to grade, anyhow, and the whole shipment is condemned. If the price of iron tend downward, the producer is in for all, or at least part of the damage. With a stationary market, it is a toss-up, and on a rising market the consumer pockets his loss. In reality, the chances are at least even that the trouble was not from the iron at all. There are as many chances as there are brands of iron in the mixture that the wrong brand was condemned. Nine times out of ten it will be used up later on, and give the best results. Making up mixtures for special purposes, depending solely upon the fracture to guide you, operates on the same principle on which the Irishman got the weight of his hog. He threw a plank across a log, which he selected with great care, balanced the plank very nicely, laid the hog on one end of the plank, and piled stones on the other end until it was accurately counterbalanced, and then he guessed at the weight of the stones. The condition of the sand in the pig beds, the rapidity with which the iron fills the beds, the side of the pigs, are all factors which greatly influence the fracture. If two pigs lying side by side in the same bed happen to be of unequal size, the larger invariably will be of a higher grade than the smaller.

If the large pig is No. 1, the small one may not show better than No. 3. Has the quality suffered because the mold was not run full? Yet this pig, with many others whose fracture suffered from similar causes, goes to the No. 3 pile, and brings correspondingly less per ton. The reverse also holds good. By proper coaxing a No. 3 can be elevated to a No. 1, and in order to please the consumer who buys on fracture, the producer does all the coaxing he can by making the pigs large, covering them up with sand, providing a third casting bed, etc., to give all the time possible for the iron to cool. Except in very wide limits, the fracture of pig iron is simply something by which to guess the quality. It is the pile of stones that counterbalances the Irishman's hog. It is something to quarrel about, and the sooner grading by fracture is abandoned the better for all concerned. Chemical composition is the only true guide by which iron can be judged intelligently as to its quality and fitness for the purpose in hand. Chemistry in the foundry is still in its infancy and much is yet to be learned. But with foundrymen's associations established all over the country, composed of intelligent and energetic workers for the practical application of scientific principles, the advantages of

chemical analysis, as well as synthesis, are beginning to be more generally understood and appreciated. It is only a matter of time when the benefits will be fully realized.

Another very eminent authority in the United States on cast iron, Dr. R. Moldenke, says at the conclusion of an exhaustive series of tests made under the auspices of the Building Department of New York, that the present method of analyzing iron by a chemist in the shape of an Irishman with a sledge has been gradually merged in the better conducted plants into plain pig iron, carrying so much silicon, sulphur, phosphorus, manganese and total carbon.

The greatest drawback to the practical application of chemistry in the foundry is that with cast iron in the sand in the ordinary way it is almost impossible to get shipments of uniform composition. This is due to the fact that the iron as it flows from the furnace is very irregular; and it not infrequently happens that there is a difference of 1½ per cent. in the silicon from the first to the last bed in a cast of iron of practically the same grade.

This difficulty will be entirely overcome when the old method of casting in sand beds, which, like the grading of iron by fracture, has been but little improved since Dud Dudley's time, will have been superseded, as it is bound to be, by the more economical and rational method of mechanical handling.

Running the metal from the furnace into a large receptacle of 20 or more tons capacity will insure a perfect mixture of that amount, which can be analyzed and piled or shipped as what it is with certainty. The time required to transport molten metal from the furnace to the machine allows the slag to separate more thoroughly, and an appreciable amount of the sulphur also escapes. The iron is not contaminated by a crust of sand or loam. The producer will know what he has to sell, the purchaser will get what he buys, and the consumer will not have to handle and remelt a lot of sand and scruff, which costs extra fuel and is liable to contaminate the product.

The first gentleman I have quoted describes tersely and accurately the conditions that prevailed up till a very late date, and I dare say it prevails to some extent in many plants at the present day. Mr. Uehling illustrates the difficulties continually arising between producer and consumer, but Dr. Moldenke truly describes what, if it is not already the universal practice among foundrymen, must in that struggle—the signs of which are everywhere apparent in the foundry trade in all parts of the world—lead to the grading of pig iron by its "silicon, sulphur, phosphorus, manganese and total carbon contents." When the blast-furnace owners and managers have come to the conclusion that the evils which they suffer from, and which they are held accountable for by the foundrymen, can be obviated, if not entirely obliterated, by grading iron in the proper way, then grading by fracture will no longer be the basis of quality and price, and the most prolific bone of contention between the producer and consumer of pig iron will be removed.

Another object which can be accomplished when this comes to pass is that the producer of pig iron can avail himself of some one of the mechanical methods which are rapidly coming to the fore, thus proving beyond doubt that their use is mechanically practicable and commercially profitable to the pig-iron maker in the handling of his product. He will be benefited by a lower cost in the manufacture of his product and by an increased value of the product itself. It is admitted by every man who knows the facts that if iron can be handled from the furnace to the stock pile by mechanical means without having to be cast in sand, you have got a product which is worth more money than if cast in the usual way. Furthermore, the foundryman himself will be benefited to an extent that he is at present perhaps not conscious of. I am not prepared to give the exact facts regarding some experiments which have been made in the United States lately in the use of sandless iron in foundry work, but I am informed from reliable sources that these experiments show a decrease in fuel cost, and a distinct saving in bad and imperfect castings, and that more iron can be melted in a given time.

I am not here to-day to advocate the adoption of any particular method of mechanical casting; that is a matter which each man will decide for himself, taking into consideration the output of his furnaces, the condition under which his product must be handled, and the wishes of his customers. It is only necessary for me to state that in the United States large concerns engaged in the manufacture of agricultural machinery buy sandless iron solely on chemical analysis, and not by fracture; and in conversation with the managers of those concerns they have informed me that they know for a fact that the chemical analysis of the material which they put into castings of their machinery helps them to gage the cost, and gives them a basis from which to calculate the strength necessary for different parts much better and more economically than when they bought their iron and melted it, depending on fracture.

Furthermore, iron cast by mechanical means has to-day among people who have used it a preference over that cast in sand, and a particular establishment I have in mind in making the above assertion is one of the best-known foundries in the United States, at which they have used sandless iron exclusively for a period of over eighteen months, and the assertions made above are derived from the foreman of the foundry department after a careful tabulation of results obtained.

This paper is not to be considered from a scientific standpoint, but as bringing before the members of the Iron and Steel Institute one of the questions that to-day is demanding attention, and which sooner or later must be solved, both by the producer and consumer of pig iron. The scientific and practical features are so interwoven that it is impossible to deal with it in its present status from a purely scientific standpoint, and my only object has been to bring the general features of the question before the members of this Institute, and to excite such discussion as will form a basis for the ultimate solution of the problem in an amicable manner and in a way that will be beneficial to all parties concerned.

Sweeping a Large Spur Pinion.

BY R. H. PALMER.

The pinion, the making of which is here described, was 5 feet in outside diameter by 2 feet face. Its outline is shown sufficiently in Figs. 3 and 7. The casting weight was about 4 tons.

Finding the size of the plates wanted, we cast in open sand, a bottom or bed plate and a cope plate *H*, Fig. 7, also shown in Fig. 6, with vent holes at *V*, also holes to bolt the cores. These holes are in a circle; one in Fig. 6 is marked *a*, showing washer and nut. The bed plate is plain, with just the holes required, while the cope plate has prickers on the face to hold the loam, those near the edge being short, while those in the circle between *s* and *s*, Fig. 7, are ¾ inch longer.

We now dig a hole in the floor and bed down the spindle seat *A*, Fig. 1, leaving spindle in the seat while doing so, and plumb the spindle, wedging under the outer edge of the seat to throw spindle either way as required, and then the sand is rammed solidly around it. The spindle is then removed, the bottom plate *J* is placed and the spindle put back. Fingers *D D* are set fast on the spindle, the strike *E E* is bolted to the fingers and raised high enough to clear the plate. It is then swung around, and the plate, if necessary, is raised to meet it. The plate being leveled, the strike is then raised high enough above this bed plate to leave room for one thickness of brick and the loam to go on top of them and for them to be laid in mud, as the molders call it. This being done, the bricks are laid, leaving them some distance apart, and having the mud very coarse and open; burnt molding sand with some fire sand mixed in, and wet with thick clay wash. Around the holes where bolts will pass through this plate to bolt down the drag cores, as shown at 3, Fig. 7, the bricks have cinders filled in between them, and only enough mud to keep them in place. The hole for the bolt is made by setting a gatestick and bricking around it, and the same for the main vent *V*, Fig.

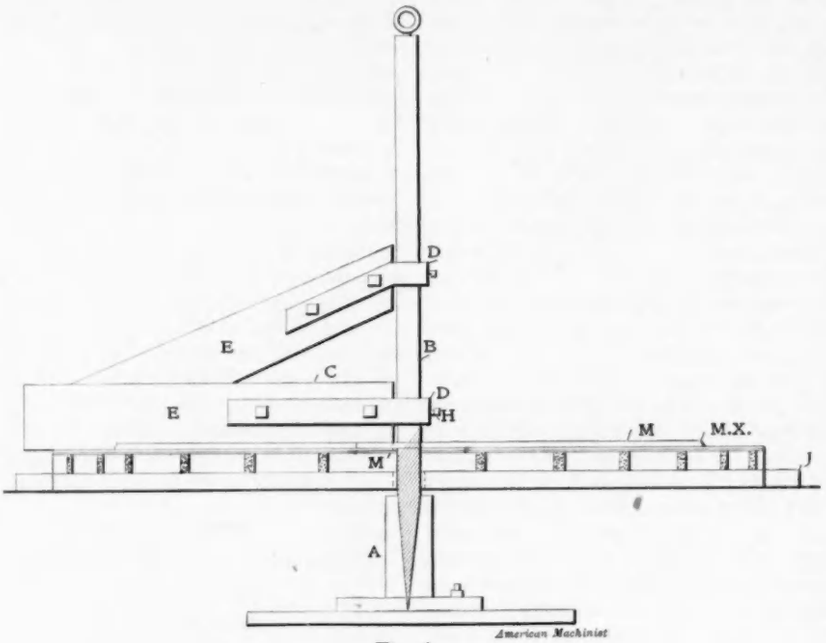

Fig. 1

THE BED AND THE SWEEP.

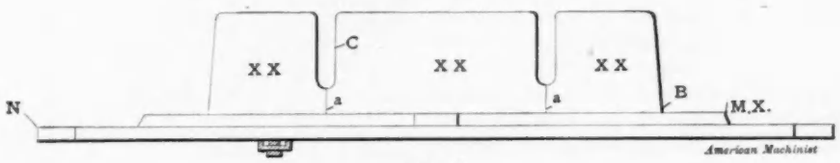

Fig. 2

COPE HALF OF MOLD.

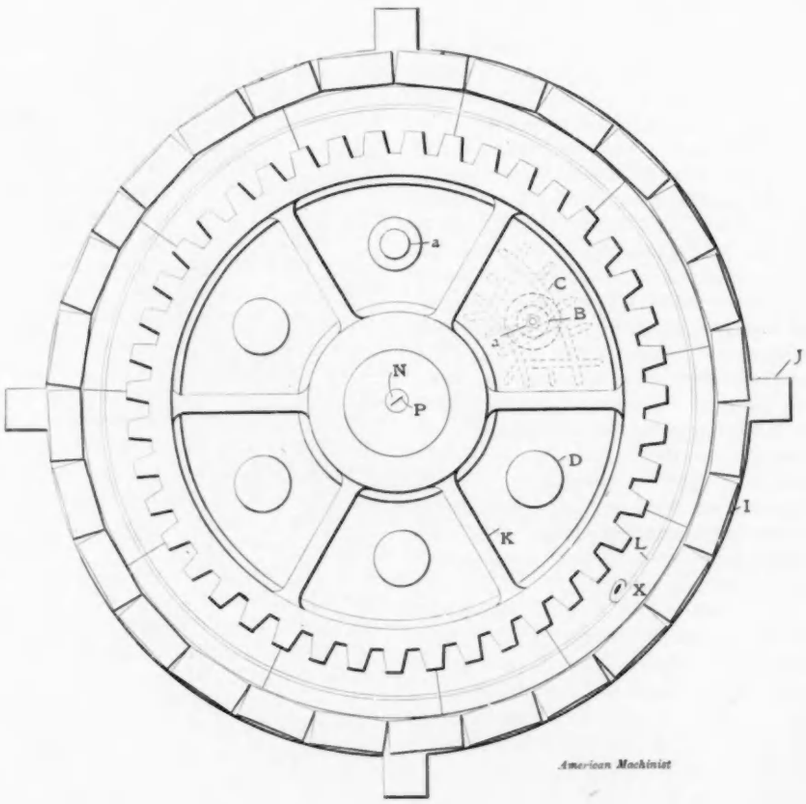

Fig. 3

PLAN OF MOLD.

7. The bricks are brought up to within the distance from the strike that the thickness of loam is to be. The bricks being set, the thickness of loam is then swept on, forming the line *M*, Fig. 1, and after being allowed to set it is given a finishing coat.

Every part of the country has its loam mixture, and every molder his favorite. A good mixture is 4 parts fire sand, 1 of coarse Jersey molding sand, 1 of white pine sawdust, 1 of ground clay, wet with water. For finishing—4 of molding sand, 1 of fire sand passed through a No. 8 riddle, wet with sour beer.

The spindle is removed and the part where the iron is to lie is given a good coat of blacking, and this part is then placed in the oven to dry. The cope plate then takes the place of the bottom plate, and a thickness of loam is swept on, gate holes, vent and riser being formed. It is the same as the drag or bed plate in general lines, except that it has the gate and riser holes in addition, and is finished the same and also is swung into the oven.

Meanwhile cores have been made, Fig. 4 which are to be bolted to the drag plate, and also to the cope, the drag cores having a print in them for core *D*, Fig. 3, *D*, Fig. 7, to set in, while the cores for the cope plate are flush and have no print. Also, cores are made to form the outside of the gear, with teeth of sand to leave larger teeth on the casting than are really wanted when finished, as these teeth are to be all machined to the required pitch. Those sections, Fig. 8, to form the outside, each have a staple in them to hook on to when setting, as have the other cores. The drag plate being dry, it is swung again to the position occupied while being bricked and loamed, but it is blocked up high enough to allow a man to get under it, and is lowered with the spindle in position, and centered by the spindle and leveled. A straight strike is now bolted to finger *D*, Fig. 1, with a finger on it set to the proper radius for the outside of cores *x x*, *x x*, *x x*, Fig. 2. The cores are then placed in position and set to the strike, and having been fitted, each core is raised and paste is applied around the outer edge on the bottom of each core, care being taken that the paste does not extend more than 2 inches inside the edge, having it just about thin enough, and seeing that there is no chance for the squeeze to force it into any vents when bolted home. As each core is taken up, pasted and replaced bolt *T* is passed down through carcass *E*, Fig. 7, also shown at *C*, Fig. 3, a washer being used underneath at *F*, with nut, and screwed up solid. In the bottom of the core are a number of channelways to bring the vent from core to hole *V*, Fig. 7. After these cores are secured we have Fig. 2 above line *N*. Boltheads *a a*, Fig. 3, are now covered over, and cores *D*, Fig. 3, Fig. 7, set to a gage, cracks between the cores, as at *a a*, Fig. 2, are slurried up,

and the whole placed in the oven for a short time.

The cope plate next takes its place, and goes through the same operation, except that there are no *D* cores to set. So we have Fig. 2, without lines *a* showing, when ready to go into the oven. The drag plate was the same, except that it had a row of bricks on top of the plate first, to give a chance for the escape of the gases.

The drag part is taken from the oven and set on a specially prepared bed, with channelways arranged to bring the gases from the cores to the outside, under the plate. Cores *L*, Fig. 3, Fig. 7, have to be set, so the bed is arranged around the spindle seat, the hole through the plate being but little larger than the spindle, and the spindle a short one. A strike is now bolted to the finger, raised as high as required, and set-screw *H*, Fig 1, is set to hold it. The shoulder is swept at *M X*, Fig. 2, Fig. 1, as a guide for bottom, and shoulder to match is in the section cores *L*, Fig. 3. A wall of brick is then laid up against the cores, but left open at places back of cores for vent to escape, *I*, Fig. 3, care being taken that the last row of bricks is even with the top of the cores. A fire basket is hung on an arm on the spindle, and the wall heated up to set the mud, the bricks are laid in. The fire basket and spindle are then removed, and a plug is dropped into the seat of the spindle and sand rammed in on top of it, then some core sand, and dried in there with a red-hot washer. The center core of the required length is then set.

The cope plate is now taken from the oven and turned over, which being done, the cores *x x*, *x x*, *x x* hang from it and it is lowered on to the drag, some flour being sprinkled along on top of cores *L*. You then have the inside as shown in section in Fig. 7; but remember that the mark on the drag must match the mark on the cope.

Finding that everything bears aright and any crushes that have appeared being repaired, the cope plate is lowered on for good, first pasting along the tops of cores *L* at *X*, Fig. 3. Clamps *a*, Fig. 5, are then slipped on over the bottom and top lugs *B C*. Wedges the same as *D E* are driven lightly in, and the mold is secured. We now have Fig. 5. The curbing *H*, Fig. 6, is then placed around and bolted together. This is made of boiler iron. The holes for gatesticks and riser have some cotton waste pressed lightly in them to keep out stray dirt, or some pieces of board are laid over them. The sand is then rammed in between the brickwork and the curb *H*, Fig. 6; the cotton waste is removed and gatesticks set in at *B B*, and riser at *C*, also *E*. These risers are to be churned. The runner box *D* is put in place, and runner *R* built. The cotton waste is removed from the vent hole, and the channelways under the mold are looked to. A coarse vent wire is run down next to the

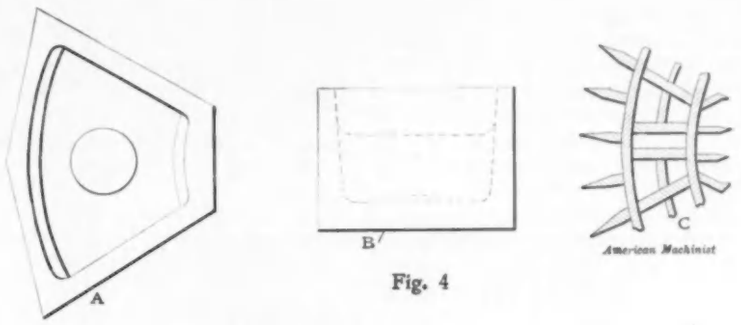

Fig. 4

CORE BOX AND CARCASS.

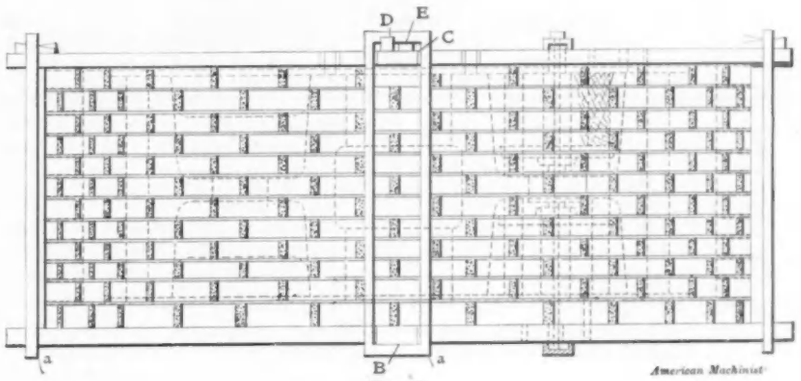

Fig. 5

ELEVATION OF MOLD COMPLETE.

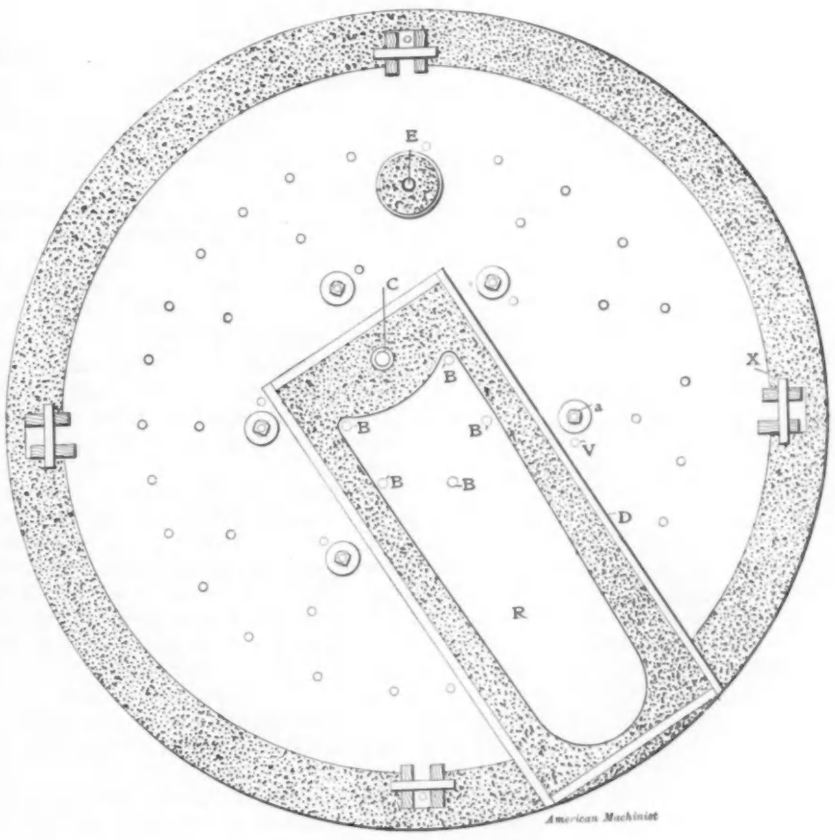

Fig. 6

TOP OF MOLD.

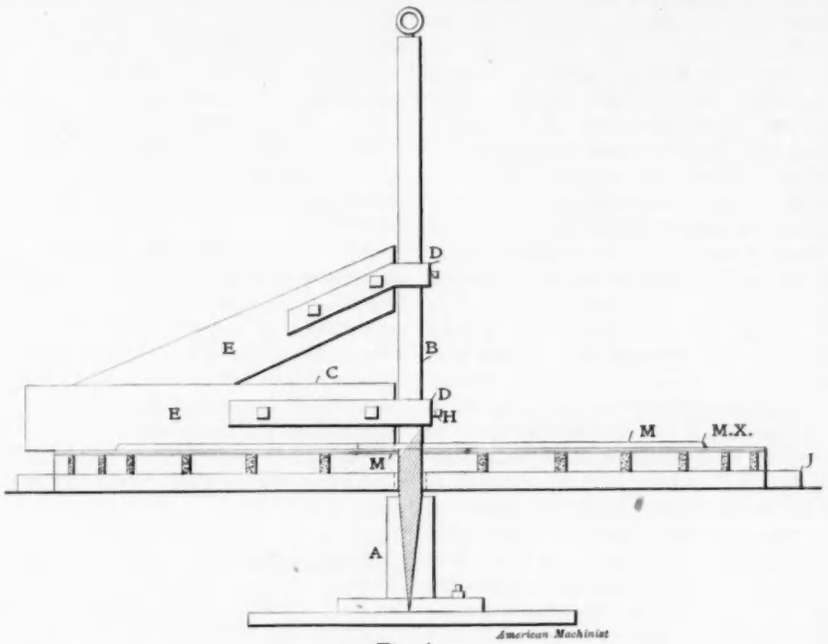

Fig. 1

THE BED AND THE SWEEP.

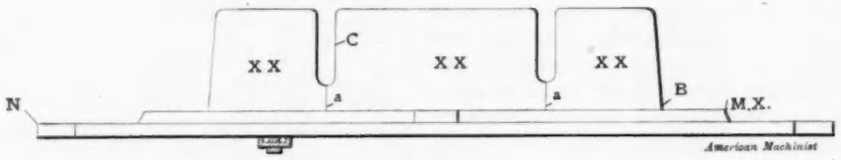

Fig. 2

COPE HALF OF MOLD.

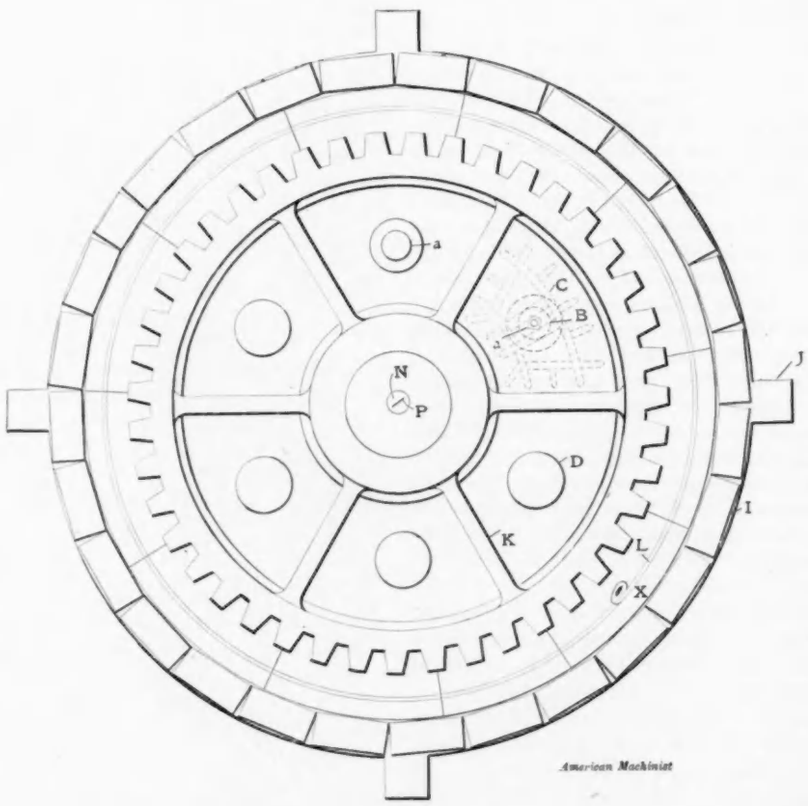

Fig. 3

PLAN OF MOLD.

7. The bricks are brought up to within the distance from the strike that the thickness of loam is to be. The bricks being set, the thickness of loam is then swept on, forming the line *M*, Fig. 1, and after being allowed to set it is given a finishing coat.

Every part of the country has its loam mixture, and every molder his favorite. A good mixture is 4 parts fire sand, 1 of coarse Jersey molding sand, 1 of white pine sawdust, 1 of ground clay, wet with water. For finishing—4 of molding sand, 1 of fire sand, passed through a No. 8 riddle, wet with sour beer.

The spindle is removed and the part where the iron is to lie is given a good coat of blacking, and this part is then placed in the oven to dry. The cope plate then takes the place of the bottom plate, and a thickness of loam is swept on, gate holes, vent and riser being formed. It is the same as the drag or bed plate in general lines, except that it has the gate and riser holes in addition, and is finished the same and also is swung into the oven.

Meanwhile cores have been made, Fig. 4 which are to be bolted to the drag plate, and also to the cope, the drag cores having a print in them for core *D*, Fig. 3, *D*, Fig. 7, to set in, while the cores for the cope plate are flush and have no print. Also, cores are made to form the outside of the gear, with teeth of sand to leave larger teeth on the casting than are really wanted when finished, as these teeth are to be all machined to the required pitch. Those sections, Fig. 8, to form the outside, each have a staple in them to hook on to when setting, as have the other cores. The drag plate being dry, it is swung again to the position occupied while being bricked and loamed, but it is blocked up high enough to allow a man to get under it, and is lowered with the spindle in position, and centered by the spindle and leveled. A straight strike is now bolted to finger *D*, Fig. 1, with a finger on it set to the proper radius for the outside of cores *x x*, *x x*, *x x*, Fig. 2. The cores are then placed in position and set to the strike, and having been fitted, each core is raised and paste is applied around the outer edge on the bottom of each core, care being taken that the paste does not extend more than 2 inches inside the edge, having it just about thin enough, and seeing that there is no chance for the squeeze to force it into any vents when bolted home. As each core is taken up, pasted and replaced, bolt *T* is passed down through carcass *E*, Fig. 7, also shown at *C*, Fig. 3, a washer being used underneath at *F*, with nut, and screwed up solid. In the bottom of the core are a number of channelways to bring the vent from core to hole *V*, Fig. 7. After these cores are secured we have Fig. 2 above line *N*. Boltheads *a a*, Fig. 3, are now covered over, and cores *D*, Fig. 3, Fig. 7, set to a gage, cracks between the cores, as at *a a*, Fig. 2, are slurried up,

and the whole placed in the oven for a short time.

The cope plate next takes its place, and goes through the same operation, except that there are no *D* cores to set. So we have Fig. 2, without lines *a* showing, when ready to go into the oven. The drag plate was the same, except that it had a row of bricks on top of the plate first, to give a chance for the escape of the gases.

The drag part is taken from the oven and set on a specially prepared bed, with channelways arranged to bring the gases from the cores to the outside, under the plate. Cores *L*, Fig. 3, Fig. 7, have to be set, so the bed is arranged around the spindle seat, the hole through the plate being but little larger than the spindle, and the spindle a short one. A strike is now bolted to the finger, raised as high as required, and set-screw *H*, Fig 1, is set to hold it. The shoulder is swept at *M X*, Fig. 2, Fig. 1, as a guide for bottom, and shoulder to match is in the section cores *L*, Fig. 3. A wall of brick is then laid up against the cores, but left open at places back of cores for vent to escape, *I*, Fig. 3, care being taken that the last row of bricks is even with the top of the cores. A fire basket is hung on an arm on the spindle, and the wall heated up to set the mud, the bricks are laid in. The fire basket and spindle are then removed, and a plug is dropped into the seat of the spindle and sand rammed in on top of it, then some core sand, and dried in there with a red-hot washer. The center core of the required length is then set.

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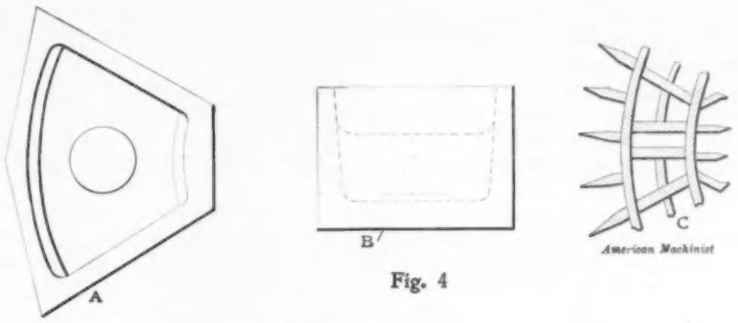


Fig. 4

CORE BOX AND CARCASS.

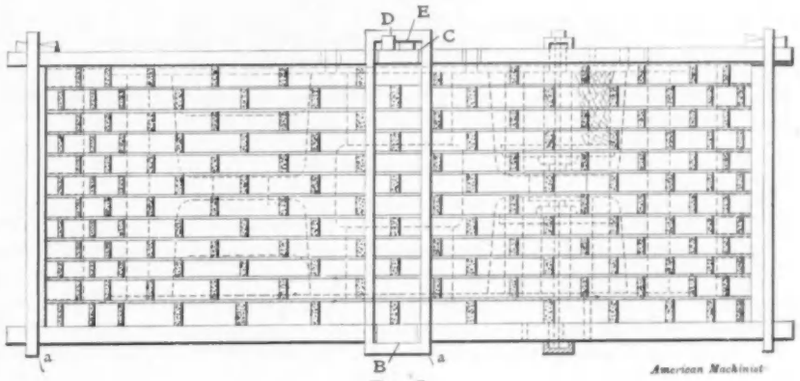


Fig. 5

ELEVATION OF MOLD COMPLETE.

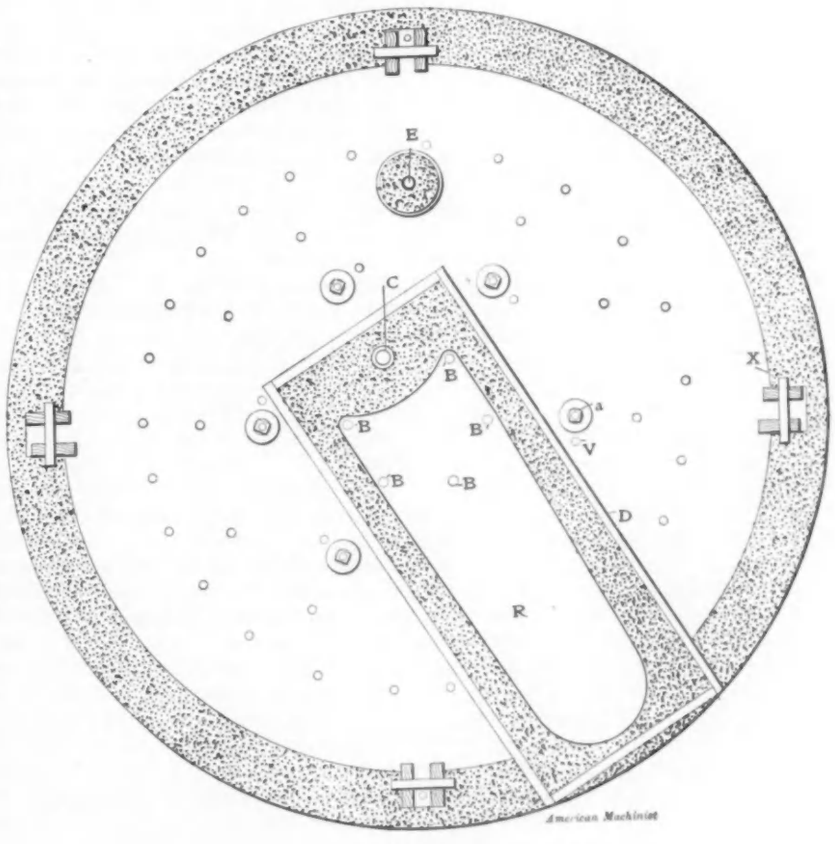


Fig. 6

TOP OF MOLD.

brickwork, to allow the gases from the teeth cores to escape. When building the runner the box is raised slightly from the plate and some straw is laid down to bring the vent to the outside of the runner box from the center core.

A and *B*, Fig. 4, show the core box for

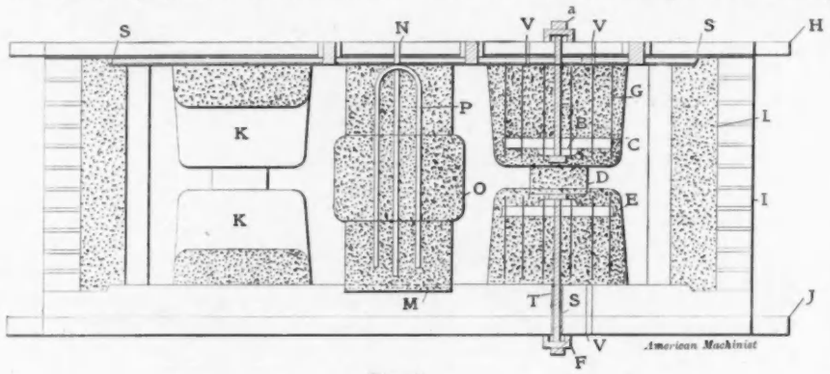


Fig. 7
VERTICAL SECTION OF MOLD.

cores *K K*, Fig. 7, while *C*, Fig 4, shows the carcass used in the core, with space for bolt to pass through to hold down the core. Fig. 8 shows the core box to form the sections for the outside of the gear, as L, Fig. 3. While I should use a special

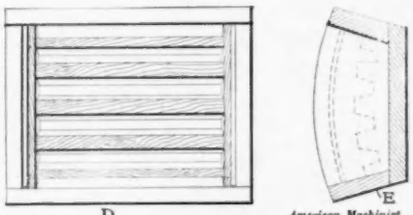


Fig. 8
CORE BOX FOR TEETH.

rough carcass cast in open sand, rods may be used, but the sand teeth must be rodded and vented. One core of the outside sections is stopped off by dropping a piece made for the purpose into the box.

Do not be in too much of a hurry to get a gear of this style out after casting.

Electric Welding on Street Railways.

At the Ithaca meeting of the Street Railway Association of the State of New York, Mr. R. F. Danforth, superintendent of the International Traction Company, Buffalo, N. Y., gave a clear and very complete account of the process of welding rails as followed by the company with which he is connected. The following portion will be of interest to our readers:

"The Thompson Welding Company has for years successfully welded together pieces of iron by the use of electricity. The Johnson Company has taken up this process with a view of welding its girder rail into continuous lengths, in the street. Its first method of welding the abutting ends of rails by bringing the joint to a welding heat by the flow of an enormous current has been found to be a failure, because the homogeneity of the metal was destroyed. In the process of welding now being used in Buffalo, it has been the endeavor to follow as closely as possible the method employed in ordinary welding. After the metal is brought to a welding heat it is worked by being put under pressure of about 35 tons, which has the same effect upon the material as the repeated blows of the blacksmith's hammer.

"Under the former process of electrically welding the ends of the rails together, the entire cross section of the rail had to be brought to a welding heat. In the process now in use the ball of the rail seldom reaches more than a dull red. It is believed that the quality of the steel in the rail head is not injured by this low temperature.

"In the true sense of the word, the abutting rails are not welded together, but the splice bars are welded to the web of the rail. These bars are of steel of the same quality as the rail, and measure 1x3x17 inches.

"The weld is made at three points, the center and ends of the bars. After the center weld is made, the ends of the bars are welded. Each bar has in the center a strip of steel pressed over the face 1¼ inches wide and ⅛ inch thick. The ends of the bar are drop forged, making a pear-shaped projection on the side, having an area of about 3½ square inches and projecting ⅛ inch above the surface of the bar.

"In order to obtain contact for the welder at the point opposite these end projections, a sheet of iron of the same shape as the projection is pressed into the depression on the back, which was made by forging the lug on the opposite side.

"The process of making a weld on old rails is in general as follows: The pavement is removed for a space of 20 inches on either side of the rail and about 40 inches along the rail and the material removed to the ties. The splice bars are taken off, and, if the bolt holes in the rail were punched, the holes are reamed out about 1¼ inches or more to remove any check which may have resulted from punching the metal. The joint is then slightly crowned by driving a wedge between the rail and the tie. The three points to be welded are then cleaned by a sand blast. The bars are placed in position, resting on small wood blocks, and the contact points of the welder placed at the center of the bars. By means of a hydraulic device, the jaws are brought together with about 14 tons pressure, the rail web is heated because of the resistance of the metal itself and the current turned on and kept up one minute until the points of contact are brought nearly to a white heat; the pressure is then reduced to about 3½ tons, and at the end of another minute or less, the metal comes to a welding heat. The current is then shut off and the pressure increased to about 15 tons and kept on for one minute, or until the metal 'sets.' The end contacts are then welded in a manner similar to the method followed in the center contacts, with the exception that the pressure, when the current is shut off, is raised to 35 tons and is kept on for two minutes. Under this pressure the bar is brought in its entire length in close contact with the web of the rail and the upset metal in the boss or projection disappears. After the weld is made the head of the rail is ground to a true surface by an emery grinder and is then complete.

"The machines used in this process may be described as follows: The current from the line is passed through a railway booster, which raises the pressure to 500 volts. (This booster is not used where the initial voltage can be maintained at 500 or over.) This direct current at 500 volts is then used to drive a rotary transformer generating alternating current at 300 volts. This in turn is reduced to five volts in a static transformer; the secondary circuit consists of a single loop of copper and its ends form the contact points which are brought to bear against the bars.

"It is found that at 500 volts the current required is about 250 amperes. The current flowing through the weld at five volts is about 30,000 amperes alternating. With this current flowing through the low-pressure secondary circuit, it is found necessary to cool the contacts by circulating water around them.

"An ingenious cooling device is used to reduce the temperature of the water so used. A tank is provided upon the top of the welding car, containing coils of pipe through which the water flows. These coils lie close together and the tank is filled with water. Air is forced through the water from a coil lying in the bottom of the tank through perforations in the coil. The evaporation from this cooling tank is found to be 47 gallons in twelve hours.

"The welder proper is in the form of a rectangle, the lower portion of which is hinged so that the parts may be moved back and forth in the plane of the rectangle. On the upper portion there is a

transformer coil, the primary of which consists of many turns of wire, the secondary being the rectangle above mentioned. This is a solid bar of copper 4½x 7½ inches in cross section. The hinges in the two sides are spherical contacts. Around the outside of this rectangle is a steel frame of horseshoe form, having at the upper end a modified hydraulic jack. The movement of the piston in the cylinder back and forth moves the lower jaws of the contact points. A varying pressure can be placed on the material grasped between the jaws. The pressure is measured by a pressure gage, placed in a convenient position. The joints in the secondary circuit, the contact points and the transformer itself are cooled by a flow of water.

"The sand blast is obtained by blowing sand, by means of compressed air, through a flexible hose. The air is compressed by a motor-driven compressor.

"The emery grinder previously referred to consists of an ingeniously designed carriage, supporting in its center the emery wheel, and running on two rollers, which are moved back and forth on the surface of the rail to be ground. Its action is similar to a carpenter's jack plane. The depth of cut made by the emery wheel is governed by means of a regulating screw, which raises and lowers the emery wheel. The wheel is driven by a belt from a collar motor mounted on the car.

"Welds can be made as described at the rate of a joint every 13 minutes. It is found that the machine will average four joints an hour without any difficulty. In Buffalo the line voltage has averaged 410, and the current required about 375 amperes.

"You probably ask why we decided to use the welded joints. The reply is that we find that the welded joint not only solves the problem of maintaining a continuous rail, but also of the best return circuit. The carrying capacity of the bars as welded is greater than that of the rail itself; there is no opportunity for electrolytic action between two dissimilar metals; there are no expanded contacts to work loose and no added investment for copper.

"Another question frequently asked is, 'What do you do about expansion and contraction of your rail?' This is solved in two ways—first, by placing an expansion joint every 2,000 feet; second, by leaving the bolted joints at the special work.

"The reason for doing the latter is found in the method of construction used in Buffalo. When the rail is laid in concrete it is firmly gripped its entire length by this mass of material. The weak points in the rail or in its concrete base are bound to be developed. If there is any tendency for the rail to contract, the movement will be greatest where the pressure upon the rail is least. The rail is liable to break under the great tension at this point. The chances are very small for this movement being near enough an expansion joint to have that joint save the rail. If the rail breaks, a regular expansion joint can be easily placed at the break. In following years the expansion and contraction of the rail will be taken up at that point. In order to thoroughly test this question, track has been laid in Buffalo, both with and without expansion joints. The coming winter will solve the problem.

"The effect upon a piece of old track, of welding the joints, is most satisfactory. In one instance we welded 6,000 feet of 6-inch girder rail, which had been in use since 1891, and whose surface was so badly bent and battered that it was thought to be well nigh useless. The rail had been originally laid on chairs with special two-tie joints. We removed the chairs and relaid the track in its proper position, but with low joints. After the pavement was in place (except at the joints) we brought the rail ends up by shims. After the welds were made and the shims removed, the track was found to be in fine condition. After this experience, we welded our track first and resurfaced and relined it afterwards.

"The cooling of the weld depresses the joints about ⅛ inch. We therefore raise the joints to allow for this depression. The old rail in question is considerably worn under the head as well as upon the ball of the rail, and it would therefore be difficult to fit loose splice bars or other mechanical joints so as to obtain a tight fit. The welded bars maintain the joint in its position and make that portion of the rail stronger than any other part.

"The cost of welded joints is not materially more than that of the bolted joint with ample bonding. The same result may be obtained with cast-welded joint mechanically, but it is doubtful whether the cast-welded joint gives as good electric contact as the method described."

A New Bearing Metal.

Prof. R. C. Carpenter, of Cornell University, has recently obtained a United States patent for an alloy possessing valuable properties for journal bearings and similar purposes. The specification sets out the properties of the metal, its composition and the mode of its preparation in a clear and highly interesting style. It says, in part:

"The principal object of my invention is to provide a composition of matter made by using a tempering alloy of such a nature that, mixed with zinc, it shall produce a composition of metals especially valuable for antifrictional purposes and which will also possess the characteristic properties of hardness, unusual strength of resistance to distortion from impact, pressure, or extension, or some or all of these strains, making it also highly valuable for other purposes, and which will also melt readily at a comparatively low temperature, flow freely, and shrink very little in cooling, so that it may be cast or poured into boxes of cast iron or other hard material or in a surrounding case, shell, or journal-box, or owing to its great strength it may be used for the journal-box itself or other purposes.

"To this end my invention consists of a composition of matter made, preferably, by combining a tempering alloy composed of copper and aluminium in such proportions that the copper shall always be in excess of the aluminium, with zinc as the preponderating metal in the composition, thereby obtaining new and valuable qualities in the composition.

"This tempering alloy is prepared by first melting the copper in a suitable furnace and then, while the temperature of the copper is but slightly above the melting point, adding gradually the aluminium, at the same time thoroughly mixing it with the molten copper by stirring. The mixture is then ready for use as a tempering alloy, or may be permitted to cool and be used at will. The melting temperature of this alloy as thus formed is considerably less than that of either of its ingredients, and it is in a condition so that it can be combined with the basic metal to form the composition for antifrictional purposes or for other uses, as required. This is accomplished by first melting the tempering alloy in a suitable furnace and then adding gradually the zinc—the predominating or basic metal—while the temperature of the tempering alloy is but slightly above the melting point, at the same time thoroughly mixing it with the molten alloy by stirring. The basic metal may be added either in the solid or melted condition. The composition is then ready for use in the various arts to which it is adapted. I have found that to make a useful and valuable alloy of said three metals for the uses and purposes herein indicated the following proportions, by weight, are best, viz.: 2 to 10 parts aluminium, 5 to 20 parts copper, and 100 parts zinc; but however much the quantities of the aluminium and copper may vary within these limits it is necessary that the copper shall always be in excess of the aluminium. The operation of mixing these metals so as to form a permanent alloy is a difficult one, and unless the process of manufacture be of essentially the character outlined, a satisfactory alloy or composition cannot be produced.

"The process of manufacturing the tempering alloy is one of great difficulty and requires special furnaces and no little skill on the part of the operator. The second operation of combining the tempering alloy with the basic metal can be performed with the apparatus found in the ordinary brass foundries and by operators of ordinary skill and intelligence. As the tempering alloy constitutes only a relatively small part of the total, the cost of manufacture is by this operation sensibly lessened without deterioration of the quality of the composition. This method of manufacture also results in producing a com-

position of more uniform quality and of superior excellence.

. . . . . .

"I believe my invention of the composition hereinabove described eliminates for the first time the objectionable qualities above referred to and combines the desirable qualities of a composition valuable for antifrictional and other purposes without weakening the structure, but at the same time maintaining a low melting point."

A Lathe with Some New Features.

A constantly increasing proportion of lathe work is being finished in the grinding machine, and progress is all the while going on toward a still more minute division of functions and of labor in machine shops. These facts are having their effect upon lathe design as well as upon other tools, and an instance of this is found in the lathe which we herewith illustrate. It is designed especially for removing stock, i. e., roughing out spindles and similar work that is to be finished either by grinding or in other ways and by the use of other tools. It includes several new features, one of these being that where, for instance, pieces to be turned have upon them a number of shoulders at varying distances from each other, the carriage can be made to automatically stop at these shoulders as the tools reach them; and upon the tool or tools being set to the new size and the feed thrown in, it goes on to the next stop, and no disturbance of the stops is necessary to allow the carriage to pass over them.

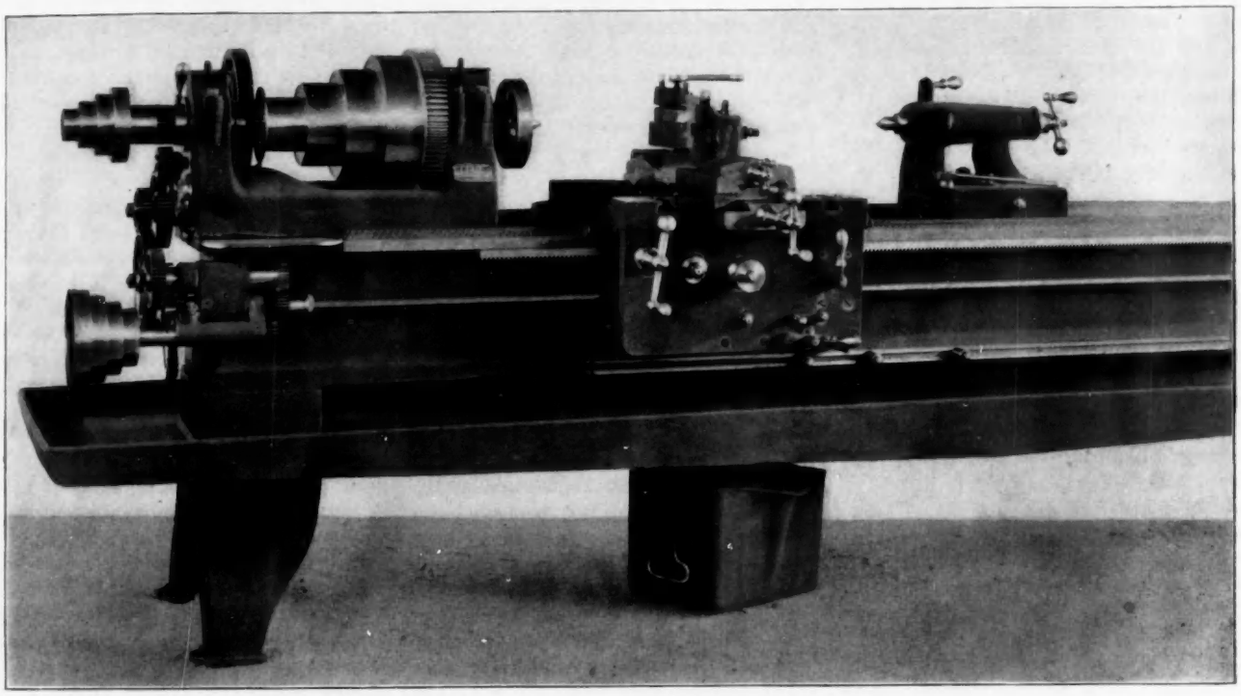


FIG. 1. A NEW ENGINE LATHE.

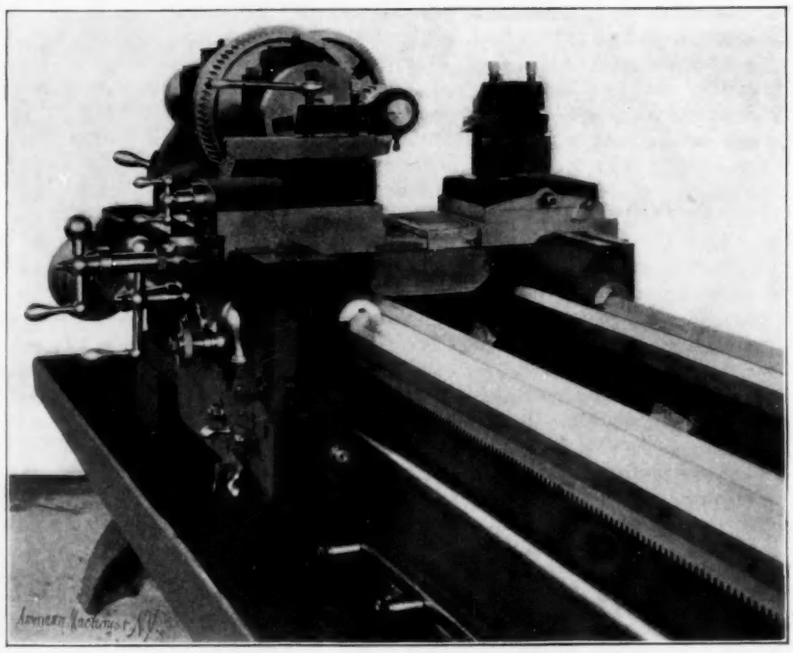


FIG. 2. SIDE VIEW OF CARRIAGE OF NEW ENGINE LATHE.

At Fig. 1 is given a front view of the lathe, at Fig. 2 a side view of the carriage, and details are shown in the line engravings that follow.

The construction of the spindle bearings is shown by Fig. 3. The boxes are of babbitt metal, which is poured into place, thoroughly pounded solid and then bored to size, making a box which there is much evidence to show is very difficult to improve upon. The caps are made as shown, with a double recess at the top, which form is adopted as part of a lubricating scheme designed to preclude the possibility of grit getting into the box. The construction here is best shown in the cross-section. Two holes are drilled in one recess and a piece of candle wicking is put through these from below, so that it has a bearing on the spindle of about one-half the length of the box. The wicking is then carried over the partition to the other recess, and packed in layers so as to absorb oil which is then carried by capillary attraction over into the first-named recess and down on to the spindle. Thus when the cover is removed only the

outer recess is uncovered; and if grit gets into it, it cannot reach the journal, because grit is not carried through wicking by capillary action.

As will be seen by Fig. 2, the carriage has two tool rests—one in front and the other at the rear. These are both moved by one right and left screw, so that they move together. The front rest has an upper slide parallel with the cross-slide, while the rear one has a slide in line with the carriage movement, thus providing for any adjustment of the tools relative to each other that may be required; and graduations on a collar on the cross-feed screw enable any setting to be restored after changing it for a different size.

The construction of the tool-holders is one of the novel features of the lathe; this being such that when the tool is removed, the holder can be swung around upon a stump to any required position; the act of tightening the tool in place clamping the holder. The means by which this is done are shown in Fig. 4, where, as will be seen, the tool rests upon two cylindrical plugs, the upper ends of which are nearly under the tool-clamping screws, and which pass downward and inward at such an angle as to make their lower extremities bear against the side of the stump, to which they are fitted. The set screw at the right prevents the holder being displaced when the tool is removed, and the vertical position of the holder is controlled by the screw at the top, which is tapped into the stump. It is easy to see that the tool is held very securely by the device, that it always rests upon a support close to its cutting edge, and that there may be the minimum of overhang in working up to shoulders or close to the lathe dog.

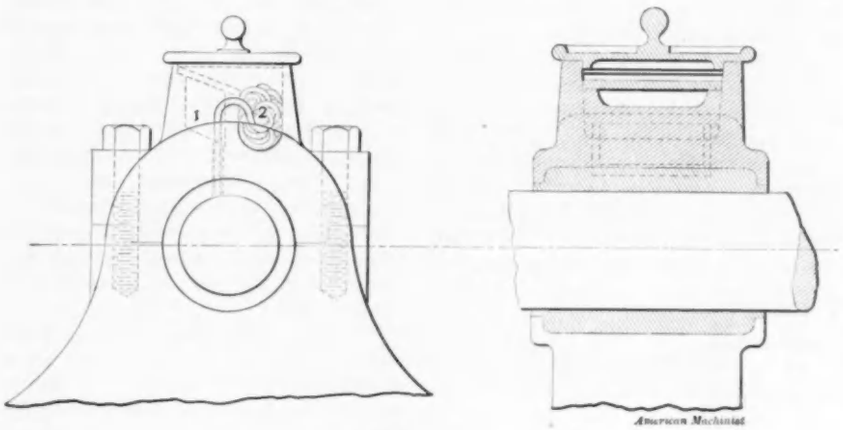


Fig. 3

SHOWING ARRANGEMENT OF SPINDLE BEARING.

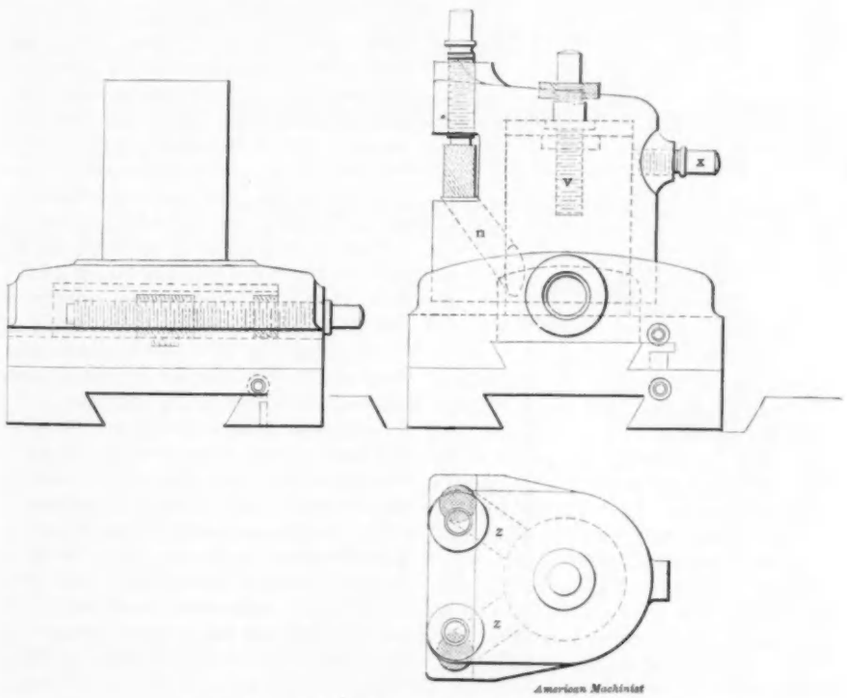


FIG. 4. TOOL REST OF LE BLOND LATHE.

The most distinct novelty of the lathe is, however, in the carriage mechanism, by which the various automatic stops may successively take place. Referring to Fig. 5, *A* is the feed rod, which does not drive the apron mechanism directly, but through the medium of the short shaft *b* below it; this shaft being driven at two rates of speed, without alteration of the feed-rod speed, by means of the double clutch and handle *c*. This mechanism is shown separately at Fig. 6, at the left of which figure is the clutch by which the automatic stop is effected.

In a T-slot which runs along the front of the bed, studs carrying rollers may be secured at any point by simply tightening a nut. As the carriage passes over one of these rollers a sliding block *d* comes into contact with it and is moved upward to pass over it. The block *d* carries on its front face a stud *e*, which, as it rises, lifts with it a plunger pin *f*, which plunger pin acts upon the horizontal arm of the bell-crank lever *g*, which is pivoted at the lower extremity of its vertical arm, so that by the upward motion of *f* the clutch *h* is disengaged and the feed thereby thrown out.

The pin *f* is not held in a fixed part of the carriage apron, but in the vertical arm of a bent lever *i*, which is pivoted in the carriage apron and has one of its arms outside, where it is provided with a handle. When it is desired that the feed shall go on again, this handle is pulled upward, which carries pin *f* to the left and off from the pin *e*, which allows the coiled spring to re-engage the clutch *h*, at the same time of course depressing the horizontal arm of the bell-crank lever *g* and the pin *f*. When the block *d*, by the feed motion, is carried forward beyond the stop roller, it drops to its lowest position again, and the bent lever *i* swings into position with the pin *f* again on top of *e*, and ready to act as before when the next stop is reached; and thus the carriage is made to stop at every desired point, and goes on again without disturbing any adjustment.

The feed is reversed in the apron by shifting two bevel pinions which are upon a sliding quill in this same short shaft, and this is done by means of the horizontal lever seen below.

The feed rod may be driven either by the belt or by the gear train, and the change from one to the other is made by shifting the intermediate seen on the rod at the head of the lathe.

As to the general features of the lathe, they will be apparent from the photograph, which shows that it is very substantially proportioned, has a powerful drive, and that provision is made for using plenty of oil or water on the cutting tools and for taking care of it. The shears on which the carriage moves are 2 inches wide at the base on an 18-inch lathe, the inner ones being smaller. The lathe is built by the R. K. Le Blond Machine Company, Cincinnati, Ohio.

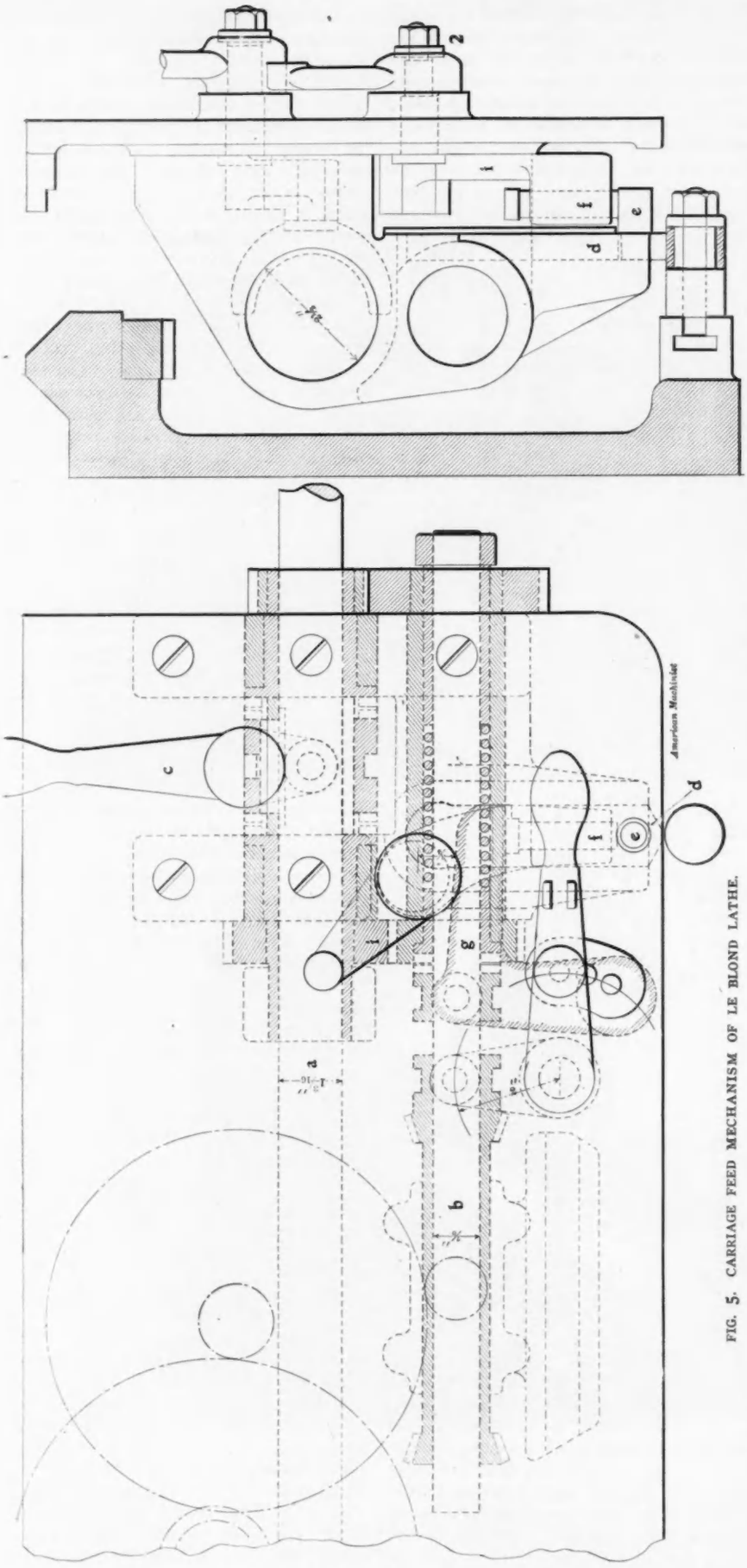


FIG. 5. CARRIAGE FEED MECHANISM OF LE BLOND LATHE.

English Workmen and Our Own.

BY RAUNALT F. KEYS.

Mr. Morris Fulton's article in the "American Machinist" of August 17, on "Automatic Machines and Automatic Men," and the reply to the same in the issue of October 12 by "English Worker," under the heading "The Libeled British Workman," are articles which should be of much interest to all mechanics who are interested in the success of American machinery abroad. Mr. Fulton calls attention to the fact that American tools, when located in English shops, cannot make as good a record for themselves as they have made at home, and, judging from his article, he evidently ascribes this under-production entirely to the workmen. Right here I want it understood that it is not my intention to attempt to prove the superiority of English workmen over our own; but it is only justice to them to mention some of the ways in which they are handicapped.

There is nothing that will make a man so patriotic, and so cause him to appreciate the institutions and people of his own country as a few years' residence abroad; and after an excellent opportunity of comparing our mechanics with those of various foreign countries, I still hold the opinion which I have held for years, that American workmen are the best in the world. There are, of course, good, bad and indifferent workmen in all countries, and while we believe that a large percentage of our men are good workmen, we have also a surprising number of a kind which we would not care to have held up as the typical American workman. Those of us who have worked in foreign countries realize the truth of Mr. Fulton's statement, that the output of our tools when installed in foreign workshops does not always equal their production at home; but for this under-production there are various reasons, and we cannot attribute it entirely to the workmen.

Now, as regards automatic machinery, of which we have sent so much abroad in recent years, it has been my experience that oftentimes the class of help employed to operate this machinery is not of as high a grade as we employ for similar work in our own shops, and when the relative production of a machine at home and abroad is considered, the fact is often lost sight of that a skilled workman is employed on it here, while abroad it may be, and is altogether too likely to be, the fact that a man with little or no mechanical training whatever has charge of the machine. It is therefore hardly fair to give the impression that machines not producing anything like their full capacity abroad are always under the operation of experienced workmen, the skilled workman having had, in many cases, nothing whatever to do with the working of the machine, the work having been assigned instead to his admittedly untrained brother.

But even in some English shops where skilled men have been employed on these machines there have been other elements which have materially retarded their output and kept their production down to a figure considerably lower than would have been reached at home. I refer to certain conditions commonly found in English shops. Some of these points were touched upon by Mr. Halstead in his consular report, from which the "American Machinist" made extracts in the issue of February 23 of the present year.

At the time of the boom in automatic machinery in Europe, and for a considerable time after, it was a difficult matter to induce English, as well as continental, buyers to purchase proper bar material and oil for the most satisfactory working of this class of machinery. More recently, however, these particular conditions have been altered for the better; but there still remain, in a great number of shops, certain features which, unless materially changed, will continue to affect to a serious extent the satisfactory operation of automatic as well as other machinery. I have reference to the lack of provision for the proper lighting and the maintaining of a suitable temperature in various shops where complicated machinery has been located, and where it is often wondered why the production obtained is not equal to the amount produced in American shops. How it is to be expected that under these conditions the highest rate of production is to be obtained is inconceivable. With the best mechanics operating, the result must necessarily be under that reached in shops where working conditions are favorable. What, therefore, must be the showing when, in addition to the improper location of a machine, it is handled by a person of no skill whatever?

Such of your readers as have spent any time in the study of machine shops abroad know that even in the largest cities there are many works with the characteristics mentioned. I remember only too well an experience I had in midwinter in starting a plant of special machinery in a large manufacturing town of England. It was the most aggravating in several years' experience installing plants in various countries. I do not wish to convey the idea that this was a solitary instance of miserable shop conditions, but that it was a little the worst of its kind. The one redeeming feature in the case was that I had the assistance of a bright, intelligent English machinist. We had no fire whatever aside from a small forge in one corner, and the oil used in the machines would set almost as soon as turned from the can, which we placed beside the forge to keep the oil in a liquid state. The oil was furnished us in very small quantities by a most miserly manager, and the bar stock furnished to run in the machines was of a miserable character, regarding both quality of the metal and the condition of the bars, which were anything but round or straight. The manager of the concern stood over us and kept as much in the way as possible, and when forced to be absent from this ice-house, his assistant took his turn at interfering with us. The floor of this shop was unfit for a stable, and machinery once located and leveled up could not be kept so for any length of time. We had light enough for working only a few hours each day. These are only a few of the conditions in the midst of which we were endeavoring to start a complicated plant. I do not need to mention the fact that our progress was anything but satisfactory to the purchasers of the machinery, to our employers, or to ourselves. It is hard to imagine a more unsatisfactory location or less favorable conditions for the successful operation of automatic machinery. While this case was —as I have already said—perhaps the worst in my experience, I have been in many works in Great Britain where conditions were only slightly better for obtaining those results which we expect from automatic machinery here at home.

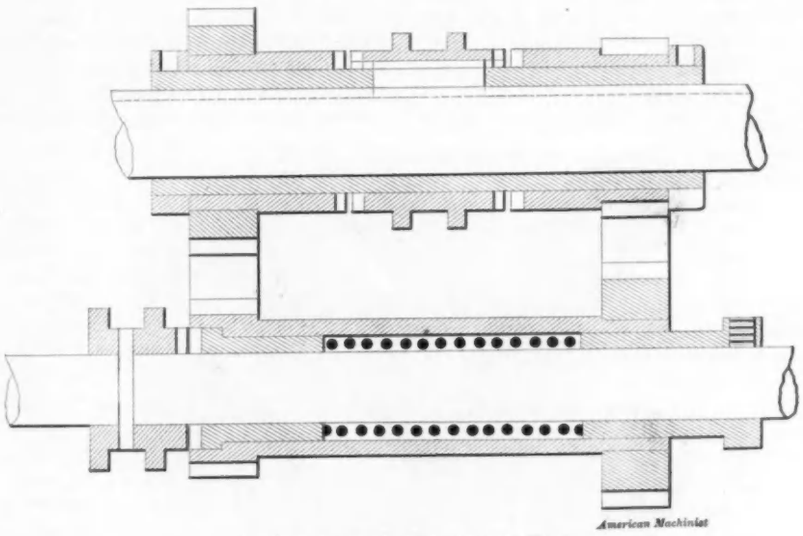


FIG. 6. DETAIL OF FEED MECHANISM.

There are, on the other hand, numerous works where attention has been paid to the proper location of special machinery, where workmen have been judiciously selected for its operation and attention has been given to the general comfort and convenience of the men in the handling of these tools, and they have then proved, in both quantity and quality of work, eminently satisfactory. For instance, a concern well known to the readers of the "American Machinist" has many American machines from various builders, in charge of English workmen of ability equal to that of the men we should select for similar work here at home. They have used as good judgment in the purchasing of material for use in these machines as we should, and I have never known of their having any trouble in keeping these machines up to their proper capacity.

"English Worker" says that it is chiefly the employers, and not the workmen, who need modernizing. I think had he said that employers, *as well as* workmen, need modernizing he would have stated the case exactly. He speaks of having worked in a shop where a good class of work was required, yet the tools used were antique and most unsatisfactory, and that the reason more improved tools were not provided was not from lack of capital, but because the firm, having always gotten along comfortably, did not feel justified in making changes for the better. This illustration is only too true of many English concerns. I had, at one time, charge of a job in the works of a well-known English concern, whose idea was evidently to make as much money with as little expenditure as possible, and to whom the purchasing of a new tool—no matter how badly needed for keeping the output even with the demand—was looked upon as an entirely unnecessary expense; in fact, as money thrown away. Their work was of the highest grade, such as we should consider here worthy of our best tools, and yet their equipment contained much machinery which many American workmen would not think of using to produce a similar class of work. To induce these people to put in modern tools was a herculean task. After a considerable time certain American tools, which seemed absolutely indispensable for some special work then in hand, were put into the works and proved to be most economical producers. The workmen, after becoming acquainted with these tools, and recognizing their general convenience and accuracy, liked them very much. And the management had continually before it an object lesson of the economy of using improved machinery; yet when I endeavored to induce the firm to put in a much-needed lathe for the lack of which we were running behind every day, it proved an even harder task than my previous undertaking. The manager happened in one morning, when one of the

lathe men was absent from the room on an errand, and seeing the lathe standing idle, said: "Why, you don't need another lathe; you don't even keep *these* busy," and all prospect of getting that new lathe for another month seemed slim. Eventually, however, we got the lathe. I should say *a* lathe—a *second-hand* one.

Such instances of aversion to purchasing improved tools are numerous, and are not usually due to lack of capital, but are more often prompted by dislike on the part of the management for altering the old-established methods. What has been is good enough, and always will be.

Is it to be expected that British workmen, who have grown old in the service of employers who care naught for progression or the modernizing of their systems, will themselves be apt to cultivate progressive ideas and endeavor to improve upon their customary methods of working? The standard of this class of workmen will, of course, never be as high as that of our average American machinist, and from this class I do not consider we have much to fear in the way of competition. They have been too long accustomed to old-fashioned tools and methods to be willing or able to take up readily the operation of our improved machinery and keep its output at what it should be. But the younger machinists, and those who have not been in a rut so many years that they have antique ideas too firmly grounded to be changed, are, I believe, in shops where modern tools are being adopted, putting both thought and energy into their work, and becoming efficient to a degree that will bring them in a few years very close to the standard of our American workmen.

I believe that environment is almost as great a factor as nationality in the making of a good or bad workman. I have worked with representatives of nearly every European nation, both at home and abroad, and have found ability in workmen of all countries, although, among those who have come under my observation, I have not found as large a percentage of good workmen as would be found here. I have noticed that the foreign machinist who comes here and enters our shops acquires in the course of time almost, if not quite, as much ability as our own men. This shows to me that the foreigner has natural ability, is ready to grasp new ideas, to put them in execution if given the opportunity, and when working under the same conditions that in the majority of shops surround our men, he advances with them.

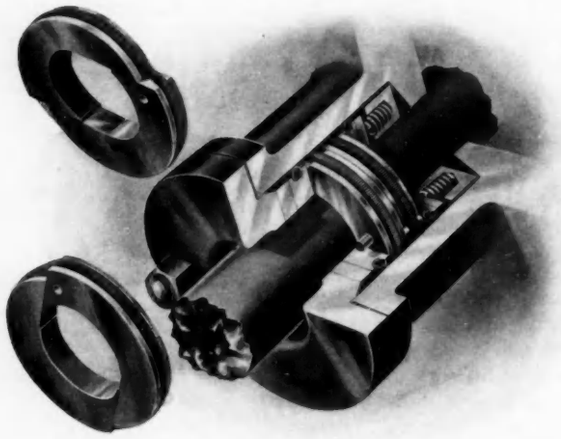
When the managers of foreign shops realize the necessity of using up-to-date tools; when ability in workmen is recognized and rewarded, and when shop conditions as a whole are raised to a level with our own, then, I think, we shall find the standard of workmanship in England and other countries very rapidly approaching that in America.

There is another element to be considered in this matter of relative production by English and American workmen; one that I have never seen touched upon, and which to be appreciated must be experienced. I have reference to climatic conditions. One must have lived for some time in certain parts of England to realize the effect of long continued depressing weather and the extent to which it handicaps one's energies. Although many people who have not lived under these conditions may not realize their importance and their bearing on this subject, I know from personal experience, and the testimony of many of my fellow-countrymen located abroad for a considerable time, that it is a factor anything but trivial.

A New Metallic Self-Adjusting Rod Packing.

The need of a self-adjusting and reliable packing for piston rods, valve rods, pump rods, and all such places, where the stuffing-box and its fibrous filling have been used from time immemorial, is fully appreciated by engineers, and the number of styles of metallic or combination and more or less self-adjusting packing that have appeared is legion. The packing shown so clearly and minutely in the half-tone is the invention of a practical engineer who has had to do with all of the most prominent of previous devices in this line. It has been used for years with success before being offered to the engineering public. It is applicable without the change of anything wherever the common stuffing-box is in use, so that if anywhere it is desirable to give this packing a trial the fibrous packing and the gland may be removed and this packing may be at once substituted, or *vice versa*. The parts of the packing are made of a metal which will not melt at any temperature, either of the steam or as caused by friction, that is encountered in service, and it is soft enough so that it will conform itself to the surface of the rod without cutting it, and even where applied to a rod which is badly scored it soon works itself tight, instead of going from bad to worse. It accommodates itself, also, to any lateral motion of the rod that may occur.

The construction and operation of the packing will be understood without difficulty upon reference to the half-tone. A piece is provided in place of the usual gland or follower of the stuffing-box, and bolted fast to the front with a steam tight joint. This piece has a hub projecting a little distance into the stuffing-box, its length being determined by the depth of stuffing-box to be filled. Next to this is a plain flat ring, ground or scraped to a bearing against the face of the hub. After this come the four packing rings proper, which are each made in two pieces, with a continuous helical spring enclosing each. These rings are not cut straight across, but overlap each other in opposite directions on the alternate sides, as shown in the loose rings at the left. After these packing rings comes another plain ring, which is held up to its place by four springs standing in holes in a ring which bears against the bottom of the stuffing-box. The several rings are placed so as to break joints, and when they are all in correct position a wire is slipped through the small holes in the collars and keeps them all from turning. Where the packing is used on condensing engines it is necessary to give a little more stiffness to the springs, no other particular being changed.



A NEW ROD PACKING.

The packing, which is known as "Harthan's Metallic Rod Packing," has been given a series of friction tests by Prof. Sidney A. Reeve, at the Worcester Institute, the results showing a saving of one-half as compared with a soft fibrous packing. It is made by the Reeves Machine Company, Trenton, N. J.

A comedian playing in New York defines a trust as "a group of men who do not trust each other, but ask the public to trust them," and a promoter as one "who has nothing to sell and sells it to those who don't want it."

Letters from Practical Men

Unrecognized Scrap.

Editor American Machinist:

In a letter of mine which appeared in your issue of October 5, under the title of "Waste and Scrap," I talked a little about the improvements in the methods and processes in all our industries which have had the result of greatly reducing the proportionate, if not the actual, amount of scrap or waste material produced. I may as well confess that I was moved to write that letter for the purpose of saving my reputation, or at least of whitewashing it a little. I wanted to show that I really can do something besides grumbling and fault-finding. I am, in fact, an optimist rather than a pessimist, and I want those who know me to know it.

Notwithstanding the exigency which compelled the writing of that letter, it was still written in all honesty of belief. In talking as I did of the diminishing bulk of scrap iron in the world, there are some other things that I might and should have said, which would have materially strengthened my position. There is, or, it will be safer to say, there has been, much waste material, iron and steel especially, which has not been recognized as scrap, and which has not found its way to the scrap heap direct from the place of manufacture. Waste material may be embodied in a structure or a machine, and be left an integral part of it, as well as it can be cut away in chips or chunks of metal. Besides what is cut off by the tools in the process of manufacture, there is in some cases much more that might and should have been cut off, or which, rather, should never have been put on, but should have been left in the pig or the ingot. It is not easy to see why this mode of wasting material is not as unprofitable, as reprehensible, as the other, and more completely avoidable. Chips we must make, more or less, but we need not make any part of an engine or a machine any stronger or heavier than it ought to be.

It was once in my way to know something about the pulley and shafting business, and I could tell of a man, a maker of this line of machinery, who had two patterns, one light and the other heavy, for most of his pulleys, hangers, couplings, collars, etc., the heavy patterns being invariably selected by him when the work was sold by the pound, and the light when the job was taken at a contract price. It would not be difficult to prove that the lighter parts, their strength being fully guaranteed, were really preferable to the heavier, and the difference in weight represented so much of an inferior kind of scrap—scrap which it would have been more profitable to have given away, but for which the full price of finished work was paid. The enterprising shafting man, thus getting finished work prices for raw material, was a business success, but it is not easy to see any element or promise of success in the practice, still too common, of putting unnecessary and useless material in any part of a machine and getting nothing for it. What is all such material but scrap? And still there are some, especially on the other side of the water, who boast of the greater weight and strength of their machines, when those not so heavy and not so strong are demonstrably heavy enough and strong enough. The measure of profitable production may be stated as the turning out of the most and the best of product with least accompanying output of scrap, and surely, where scrap is embodied into a machine, that should be counted with that which is shoveled up under the lathes and the planers.

This is not in any way a plea for undue lightness anywhere, but for the equitable distribution of sufficient material. Every part amply strong enough, and "every part as strong as the rest" are conditions that we would insist upon, but all material in excess of that anywhere we are quite disposed to regard as scrap.

In promoting this equitable, and therefore economical, apportionment of material the technical schools and their scholars have done the most practical work of our time. They have introduced new and correct principles and practices. A machine is not now designed by the unaided judgment and the eye, as an artist models a statue, but the strength of the materials and the required sizes of the parts for the ascertained speeds and stresses are matters of careful and exact computation. Only in this way has it been possible to get just enough everywhere and not much in excess anywhere, and those who have introduced and helped along our modern systems of testing, of recording, and of computing have been the greatest savers of scrap. Thus the saving of scrap in advance, by the avoidance of its production, is a vastly higher function than the utilization of scrap after it has been made.

TECUMSEH SWIFT.

Scroll Chucks.

Editor American Machinist:

The article which appeared in the "American Machinist" of July 13, entitled "Scroll Chucks," by Mr. Tecumseh Swift, could not but leave a bad impression regarding this very useful device, and while his remarks may have been occasioned by some unfortunate experience with a poorly constructed chuck years ago, they cannot justly be held as giving all the facts in the case, nor as representing the experience of hundreds of others who are to-day using them successfully.

The mechanical efficiencies of scroll and geared chucks have been compared by Mr. Whiton, and I shall not attempt to add anything to that phase of the discussion.

The use of scroll chucks has largely increased since the introduction of heavy turret lathes, and there does not seem to be much reason to think that those who order such machines desire any substitute for the scroll chuck, or, at least, as there is nothing better to offer, are not willing and anxious to accept the best they can procure.

Like any other piece of mechanism, if it is not constructed with the same amount of good workmanship and good materials necessary to produce the best possible product, it may be a source of trouble and be condemned from the time it is placed on a machine, but when it is possible to obtain as accurate work as can be done with soft jaws and supporting arbors on a modern turret lathe, it seems as if there is very little to complain of, and results speak for themselves.

An improvement has also been made in the jaws, whereby the necessity for removing them has been eliminated, and this is accomplished by making the base which engages with the scroll a separate piece from the jaw, the latter being screwed and tongued on the base.

As Mr. Swift says, there have been improvements in the making of scroll chucks, and as that is all the credit he does give them we are at least hopeful for the future, and hope that the scrap heap will not claim all of them now in existence. The records of at least one concern using scroll chucks on a line of machines which have been very extensively introduced, both in America and Europe, contain very few complaints regarding chucks sent with their machines, and the probabilities are that if much complaint existed they would surely know of it.

In their own workshops there are chucks in use which after ten years are still giving efficient service, records which do not require much comment as to their value.

When the statement is made that you never can screw up a scroll chuck tight enough to hold a piece securely, it does not agree with the facts in the case, as, unless the reverse was true, the wide shaving cuts required in finishing castings in certain turret lathes could never be taken, and that such methods of finishing castings have become popular cannot be doubted by those who care to investigate the matter.

The cases where the scroll threads are broken, due to the pressure of the jaws upon them, would seem to me to be of rare occurrence, as they surely ought to be stronger than the teeth in the jaws, and the fact that the latter are hardened would tend to cause breakage in them first.

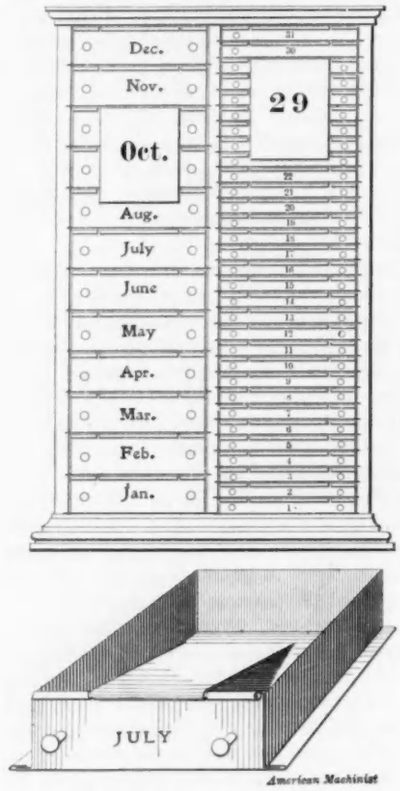
In conclusion, I would say that in case the scroll chucks in use at the present time were such inefficient devices for accomplishing such a useful purpose as Mr. Swift would have us believe, we might all be sorry with him "that this is thus."

P. J. C.

A Handy Calendar and Prompter—"Made in Germany."

Editor American Machinist:

In the course of a visit to one of the largest electrical concerns here, popularly spoken of as the "A. E. G.," my eye was caught by what seemed about the most elaborate wall calendar that I ever ran across. As this concern prides itself on



A GERMAN CALENDAR AND REMINDER.

possessing an essentially American spirit of commercial utilitarianism, I, as a good American, immediately tried to score a point by showing them that, after all, they had not quite got there, as no Yankee would ever devise so handsome a case and elaborately fit it with metal drop leaves merely for a calendar. But "Wer Anderen eine Grube gräbt, fällt selbst hinein" (digging a hole for another he falls into it himself) is a good German adage that was once more to be proven. This calendar, "made in Germany," turned out to be really the most admirable arrangement of a prompter and calendar that I had ever seen.

Reference to the illustration shows it to consist of a wooden case, containing two vertical rows of boxes. To the left are twelve boxes, each labeled in small characters with the name of the month. To the right are thirty-one similar, but shallower, boxes, one for each day of the month. The tin bottoms of the boxes are extended on each side to form tongues to slide in sawcut grooves in the case. A drop leaf is hinged to the upper edge of each box front, and on the under side of this leaf the name of the month or day of the month is painted in very bold characters. Memoranda are distributed to the various monthly boxes. On the first of the month its box is pulled out, the loose drop which has served to weigh down the notes is dropped to the front, to expose the name prominently, and the drawer returned to place after the notes have been removed for detail distribution in the day drawers. Each day the proper day drawer is pulled out to have its drop let down to serve in its capacity as a calendar, and the notes contained in it are removed for action. The whole get-up is a very neat and decidedly creditable solution of a problem that has often been attempted, but has never, to my knowledge, been so well solved.

HENRY HESS.

Berlin, Germany.

Jobbing Work at Gold Town.

Editor American Machinist:

One of the various jobs which I noticed passing through the Judge's hands was making occasionally one or two tube-expanders of the Dudgeon type. The interesting feature was the making of the three oblong holes *A A A* in the body, Fig. 1, of

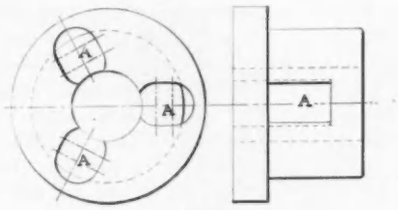


Fig. 1

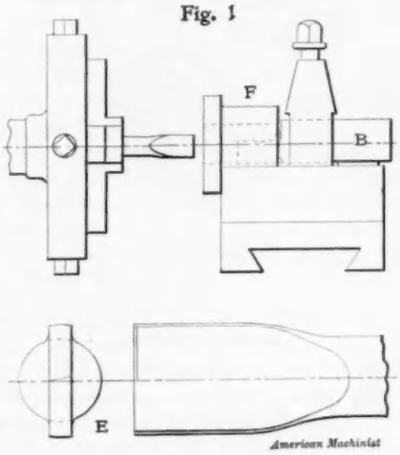


Fig. 2

CUTTING OUT OBLONG HOLES.

the expander. This piece was held as at *F*, Fig. 2, in the tool block of the "rise and fall' rest of the lathe, and clamped by the stump of a boring tool *B*, tightened by the tool-post screw. The flat drill, shown enlarged at *E*, was held in the chuck, and by feeding the carriage toward the head stock the two outer circles of the oblong hole were drilled, and then by using the cross feed the sides of the hole were milled straight. The piece was reset for the second and third holes, which were drilled and milled in the same manner.

This flat drill, ground with reasonable care by hand, can be made to cut nice short keyways, holding the drill in the lathe chuck and clamping the shaft to the tool block. It can be made to bore or mill holes or grooves considerably larger than itself, adjusting the size by setting it out of the center with the independent chuck jaws and cutting with but one lip. As a makeshift it is sometimes very useful.

The heads or covers, Fig. 3, for the cylinder or casing of a rotary engine having the groove *H* to be finished came to the Judge. Hand work was useless, so a former *A*, Fig. 4, was made, the shape and size of the inside of the groove *H*, Fig. 3, and screwed to the side of the lever *B*, the screws passing through the lever and tapped into the cylinder head and holding the three pieces firmly together. A piece of ¾-inch round iron was bent at a right angle and the shank threaded and held fast in the lathe tool block, as at *C*, by the two nuts. This formed a fulcrum for the lever *B*. A worn-out lathe center still had stock enough to make a stud *D*, the width

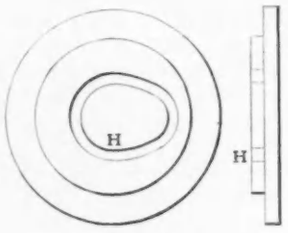


Fig. 3

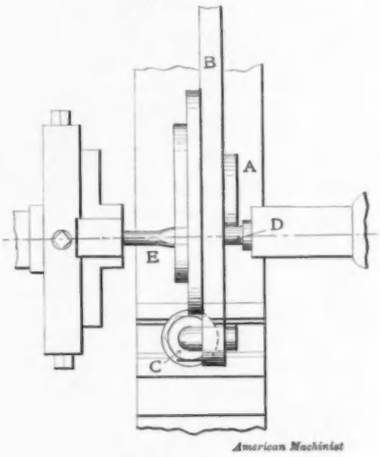


Fig. 4

CUTTING CAM GROOVES.

of the groove *H* in diameter. The flat drill or mill *E*, ground carefully, was chucked true, and a helper at the end of the lever *B* held the former firmly against the stud while the carriage and tail-stock spindle were fed toward the head stock till a hole was drilled the depth of the groove intended. Then, by feeding slowly forward and backward with the cross-feed screw, the former at all times held firmly against the stud while following around it,

a very fair job of profiling was accomplished. Five days' hand work wouldn't have made as good a job of those two heads as five hours, making the rig and machining the grooves, did by this method.

SAMUEL A. BETTER.

Junior Mechanical Engineers' Meeting.

The next monthly meeting under the auspices of the Junior Committee of the American Society of Mechanical Engineers will be held at the Society House, 12 West Thirty-first street, on Tuesday evening, November 7, at 8.30 o'clock. A paper will be read by Mr. Fred. H. Colvin on "Compound Locomotives." It will be copiously illustrated by lantern slides, and an informal discussion will follow.

Resolutions by the Employees of the Brown & Sharpe Manufacturing Company on the Death of Mr. Sharpe.

At a meeting of the employees of the Brown & Sharpe Manufacturing Company, held October 21, 1899, at which representatives from the different departments of the works were present, a committee was appointed to give expression to their feelings on the death of Mr. Lucian Sharpe and to present the same to the family of the deceased and to the local and mechanical press. The following expression was adopted:

Whereas, Our respected employer and esteemed friend, Mr. Lucian Sharpe, has been removed from among us by death, we, his employees, desire to express our personal sense of loss, our appreciation of his character and our sympathy with his bereaved family.

In the death of Lucian Sharpe we have lost a just employer and a kind friend; this community a distinguished citizen, a wise counsellor, a true gentleman and an honest man.

We appreciate the strength and nobility of his character, his kindly spirit, his scrupulous integrity and his profound common sense. In the management of his business he was himself as prompt and attentive to details as he would wish others to be, and his acts and influence tended to elevate his employees. His effort to express exact truth in every production will remain with us as a worthy example and a perpetual inspiration.

We extend our heartfelt sympathy to his bereaved family, and shall ever aim to show it by that faithfulness in our several positions which so thoroughly characterized him in all the relations of his life.

OSCAR J. BEALE,
WILLARD T. HATCH,
(Signed) ALPHEUS L. GREENE,
L. D. BURLINGAME,
D. D. DONOVAN.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Rawhide, fibre and hard rubber gears. The Arthur Co. (See page 8.)

Construction and repair of Commutators, 50c. L. C. Sharp, Omaha, Neb.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Engineers and firemen, send 2 cents for 24-page pamphlet containing list of questions asked by Examining Board of Engineers. Geo. A.Zeller,bookseller,St.Louis,Mo. Mention A. M.

Wanted to Buy—A second-hand Roper caloric engine of about 2 H.-P., in good working condition. Address all particulars as to price and where it can be seen to "Caloric," care AMERICAN MACHINIST.

Patent rights for sale; internally threaded surface calipering device to apply to any inside calipers; very handy and exactly accurate. For particulars address Edward N. Bowker, 53 Lemont st., Bath, Maine.

An experienced designer will furnish complete and original working drawings to any concern desiring to build a line of trade duplex pumps up to 10x6x10 in.; write for prices. Box 340, AMERICAN MACHINIST.

Wanted—Partner, with from $5,000 to $100,000, to engage in lucrative manufacturing business; cheapest fuel in the world; building site free; rare opportunity for permanent business; articles to build; sure sale. Address Box 375, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Position wanted as draftsman, by a Maine man with 2 years' experience; start low. Box 377, AMERICAN MACHINIST.

Wanted—Situation, by good machine draftsman; have had drawing-room experience; moderate salary. Box 382, AMER. MACH.

A mechanical draftsman, 11 years' experience in millwright work and mill work; good recommendation. Address Box 383, A. MACH.

Party with machine shop and drafting room, general supervision of details and management of labor, desires a situation. Box 1429, Boston, Mass.

Draftsman and designer of Corliss engines, air compressors, automatic machinery, etc., desires change; competent to take charge. Box 381, AMERICAN MACHINIST.

An experienced assistant superintendent and designer of tools and jigs wants position as superintendent, assistant superintendent or chief draftsman. Box 378, AMER. MACHINIST.

Wanted—Situation as steam engineer; 20 years' experience with triple-expansion, compound and high-speed engines; 3 years in erecting marine engines. Address B. F. Miller, Terra Cotta, Ill.

A Connecticut man, age 31, with 14 years' mechanical experience, would like a position as foreman or superintendent in a small factory; last 6 years spent in perfecting knitting machinery. Address Box 376, AMER. MACH.

A mechanical engineer, 30, machinist by trade, 6 years in drafting room of leading manufacturers, 2 years as superintendent, desires to correspond with firm needing a mechanical man. Address Box 385, AM. MACH.

Position wanted by an American, age 24; several years' experience as stock clerk in office of large manufacturing concern; up to date in shop system; hard worker; good habits; references. Address Box 380, AMERICAN MACHINIST.

Thoroughly capable mechanical expert desires absolute charge of mechanical work in factory employing 300 or more hands; perfect systematizer; 20 years' experience from job shop to fine interchangeable work. Box 357, AMERICAN MACHINIST.

Mechanical superintendent with 15 years' experience on light manufacturing, small interchangeable work, tools, jigs and fixtures, desires change; recently superintendent of a well-known make of typewriter; A1 references. Address Box 379, AMER. MACHINIST.

American, 36 years of age, wants to change; has had wide experience in design of engines, pumps, boilers, mechanical stokers, coal mine machinery and locomotives; also good at photo work; cannot consider salary below $125 per month. Box 384, AMER. MACHINIST.

Help Wanted.

Wanted—An experienced designer on jig and tool work. Box 338, AMER. MACHINIST.

Wanted—An efficient machinist to take charge of gang in machine tool shop. Box 339, AMERICAN MACHINIST.

Wanted—Detail draftsmen and experimental hands on shoe machinery. McKay Metallic Fast. Assn., Winchester, Mass.

Wanted—A draftsman; one who has had experience on electric or hand traveling cranes. Box 388, AMERICAN MACHINIST.

Draftsman; hoisting machinery; young, active, experienced only need apply; permanent position to right man. Box 386, AM. MACH.

Wanted—Foreman for machine shop. Apply by letter only, stating qualifications and experience, Hilles & Jones Co., Wilmington, Delaware.

Wanted—Draftsman; thoroughly competent man; one accustomed to engine and sawmill work preferred. Waterous, Brantford, Canada.

Wanted—Good, all-round machinists on new and repair work; state age, experience and wages wanted. The Beall Machine Co., Cumberland, Md.

Wanted—A few good machinists, accustomed to light work; steady employment given. Address A. H. Relgeur, 66 Auburn ave., Buffalo, N. Y.

Wanted—Five first-class machinists, familiar with high-grade machine tool manufacturing; give age and experience. Landis Tool Co., Waynesboro, Pa.

Wanted—First-class machinists, both erectors and machine hands; good pay and steady work to first-class men. Watertown Engine Co., Watertown, N. Y.

Wanted—Two or three good, all-around machinists for new and repair work; state age and experience fully. Address Box 365, AMERICAN MACHINIST.

Wanted—Foundry foreman; chief work light and heavy power transmission; foundry equipped with air hoists and molding machines. Box 389, AMERICAN MACHINIST.

Wanted—Experienced factory superintendent; one familiar with gun work preferred. Address "Superintendent," care Star Manufacturing Company, 47 Dey st., New York.

Wanted—A live man to take charge of machine shop employing 40 men; one having some knowledge of electrical work preferred; state wages, etc. Box 364, AMER. MACH.

Machinists wanted; a number of first-class men on high-speed marine engine work. Apply Gas Engine & Power Co. and Charles L. Seabury & Co., Consolidated, Morris Heights, New York City.

Machinists wanted; a few good lathe, planer and milling-machine hands, for steady work; location a short distance from New York. Write, stating ability and where previously worked, to Box 368, AMER. MACH.

Wanted—Expert machinist for experimental work, able to help in drafting, with experience on the Mergenthaler Linotype preferred; state experience in detail and salary expected. Box 370, AMERICAN MACHINIST.

Wanted—One good machine blacksmith for heavy and light work under steam hammer and anvil; permanent position and good wages for suitable man; state age and experience. Address Box 366, AMER. MACHINIST.

Wanted—Three good planer hands who can plane lathe and planer beds, etc.; also four good fitters on machine tools and two good draftsmen on machine tools. Address Box 387, AMERICAN MACHINIST, and state wages wanted and experience.

(*Continued on page* 38.)

Inquiry for Machinery.

(111) Machinery used in the manufacture of sand paper.

Personal.

Mr. Loewe, of Ludw. Loewe & Co., Berlin, who has been spending the past few weeks inspecting machinery matters in this country, sailed for Europe on the 31st ultimo.

Mr. C. H. Greenwood, who has been connected with the Atlas Tack Company, of Taunton, Mass., has been appointed an instructor in Mechanical Engineering at the University of Pennsylvania.

Mr. Francis Fenwick, of Fenwick Freres & Co., Paris, arrived here several days ago, and will spend from six to eight weeks looking into machinery matters. He may be reached while in this country by addressing letters to him at 50 West Twenty-eighth street, New York city.

Obituary.

Ottmar Mergenthaler, the inventor of the linotype machine, died on the 28th ult. We expect to give some account of his life and attainments in a future issue.

Sterry Smith, an old foundryman, died at Salem, Mass., October 24, seventy-eight years old. Mr. Smith was born at Foster, R. I., and when fifteen years old he went to Cranston, R. I., where he learned to be a molder. He worked for some time in Springfield, Mass., and soon after coming of age he went into business for himself at Nashua, N. H. In 1845 he established the Smith Foundry in Salem, in which business he continued, with two successive partners, until 1883, when he sold out and established another foundry at Lynn, Mass., finally retiring from business about seven years ago.

Manufacturers.

There is a probability that the Kratz Foundry & Machine Works, of Evansville, will be moved to Owensboro, Ky.

The American Steel & Wire Company, of Chicago, will erect a new steel plant on Neville Island, in order that it may have a finishing mill near its blast furnaces in Woodsum, Pa.

Lake Shore Engine Works (Incorporated), Marquette, Mich., successors to Lake Shore Iron Works, have recently enlarged their facilities by equipping a new machine shop with special machinery.

The Shelby Tube Works, at Greenville, Mercer County, Pa., will be enlarged. The workmen will be increased from 250 to 800. The company is making boiler tubing for battleships for the government.

Capitalists are negotiating for the purchase of a large tract of land from William Simpson's Sons, Eddystone, Pa. The new company proposes to erect and operate an iron plant to employ 1,000 hands.

Plans for the enlargement of the rolling mills at Columbia Heights, Minneapolis, Minn., have been approved by the Republic Iron & Steel Company directors, and the long

(*Continued on page* 39.)

Help Wanted—Continued.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite applications from draftsmen, pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—A first-class running engineer for high-speed compound condensing plant with 120 K. W. alternating generator; must be sober and capable of making his own repairs; good wages and steady job to the right man. Address X. T., AMERICAN MACHINIST.

Wanted—First-class foreman for machine shop, building steam engines and a general line of repairs; in applying state age and experience fully and salary expected, and how soon you could come if employment was given. Address Box 367, AMER. MACHINIST.

FOR SALE.

Hartson Planer, 38 in. x 20 ft., running gears, shafts and bearings all new.

H. G. FAY,
84 Sedgwick St., BROOKLYN, N. Y.

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"TOLEDO, OHIO, July 10, 1896.
The Burt Mfg. Co., Akron, O.
Gentlemen—Yours of the 7th inst. at hand. Must say that it paid for itself in one month. Would not be without it.
GENDRON WHEEL CO."

Shall we send you a **CROSS OIL FILTER** on 30 days trial?
Send for Catalog 16.

THE BURT MFG. CO.,
AKRON, OHIO, U.S.A.
Largest manufacturers of Oil Filters in the world.

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W. R. SAWYER, Lessee.
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GEARS of all descriptions

We Make a 15-Inch Universal Monitor,

fitted with Friction Back Gears, Chaser, and with Set-over and Swivel to Turret. The turret is revolved by hand, and is provided with both lever and screw feed; has also a swivel adjustment, and screw cross feed for facing work. The chasing apparatus is arranged to cut both straight and taper threads, and has our improved follower, which can be made without a hob. Hadn't you better send for our free catalog.

The Windsor Machine Co., Windsor, Vt., U.S.A.

Machinists---Moulders.

Forty-seven vacancies to be filled either by former employees or new men.

We want efficient machinists and moulders willing to work under the Premium System, administered with liberal time limits. No Charges, and guarantee of good pay with opportunity to make more.

A portion only of our employees have struck against any change from the old day-work system, in use here for forty-two years, and although many of them have taken jobs in other shops, their committee undertakes to rule this shop and asserts its intention to defeat the introduction of any system designed to fix some exact relation between the amount of pay and the amount of work performed.

Shops well equipped, well lighted, steam heated and sanitary. Address or apply to

CHAMBERS BROTHERS CO.,
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PATENTS secured in the United States and foreign countries. Investigations as to novelty and validity. Litigation conducted in the Courts and Patent Office. Members of the bar of the United States Supreme Court and various Circuit Courts.

BALDWIN, DAVIDSON & WIGHT,
25 Grant Pl., Washington, D. C. 141 Broadway, New York.

WANTED. An experienced and capable advertising solicitor. One who is well acquainted with the large manufacturing industries in the engineering and mechanical trades of the country. Also local ones for Pittsburgh, Boston, Cincinnati, St. Louis, and other cities throughout the country. References.

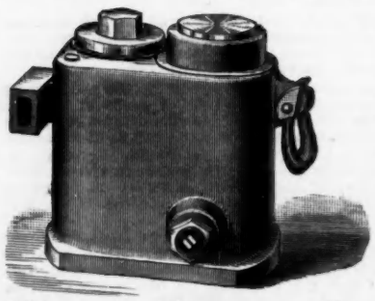
S. E. HENDRICKS CO.,
61 Beekman Street, - New York.

In Cases Where Screws or Bolts Are to be Threaded

to a positive distance, and work or tools would be ruined if they were threaded any farther, this is the tool to use. With any other tool this would be a delicate operation, requiring unusual expertness. Made to automatically release and turn with the work at any desired point, by simply setting the stop-screws on tail block of screw machine. These are not carried in stock, but are made to order, promptly, on receipt of the necessary dimensions. Send for our 204 page Catalog.

Wiley & Russell Manufacturing Co., Greenfield, Mass.
Selig, Sonnenthal & Co., 85 Queen Victoria Street, London.

Your Kind of a Jack



is somewhere among the 257 different kinds the Watson-Stillman Co. make—that's pretty sure. If, by any possibility, it shouldn't be, the Watson-Stillman Co. are just the people who can make what you want, at a fair price.

In addition to their immense line of Jacks, they make all sorts of good Hydraulic Tools.

Watson-Stillman Co., 202 East 43d St., New York City.

Selig, Sonnenthal & Co., London. Adolphe Janssens, Paris, France; Brussels, Belgium.

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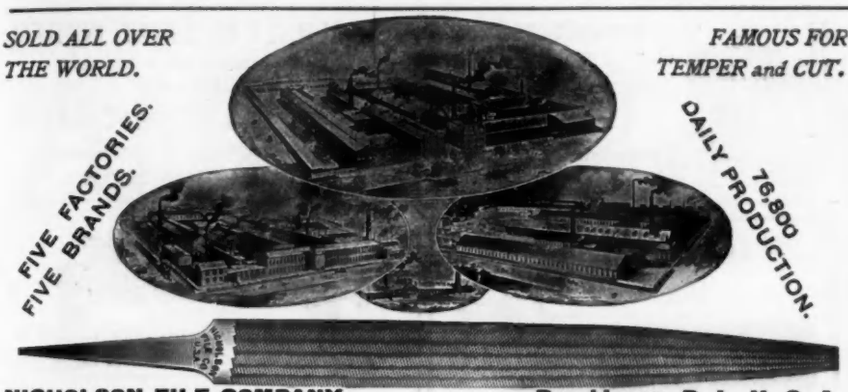

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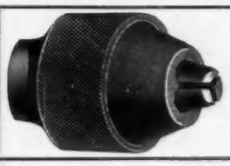
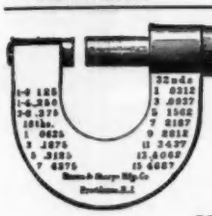


Almond Drill Chuck.

Sold at all Machinists' Supply Stores.

T. R. Almond,

83 & 85 Washington St. Brooklyn, N. Y.



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The Brown & Sharpe No. 8 Micrometer Caliper with Ratchet Attachment.

SEND FOR OUR CATALOG OF MACHINISTS' TOOLS.

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SUCCESSORS TO

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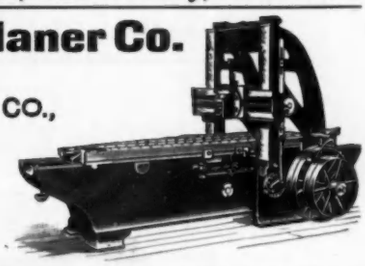
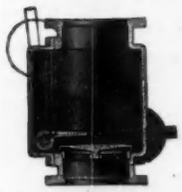


U. Baird Machinery Co., 125 Water St., Pittsburgh, Pa.
Robinson & Cary Co., St. Paul, Minn.
W. R. Colcord Mchy. Co., 502 North 2d St., St. Louis, Mo.
Parke & Lacy Co., Fremont St., San Francisco, Cal.
The Fairbanks Co., 705 Arch St., Philadelphia, Pa.



Excelsior Straight-Way Back Pressure Valve.

This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

Jenkins Brothers, New York, Boston, Philadelphia, Chicago.

THE STRENGTH OF MATERIALS.

A Text Book for Manual-Training Schools. By MANSFIELD MERRIMAN.

Forty Illustrations. Eleven Tables. Numerous Practical Problems.

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has several times the efficiency of emery. That means that one pound of Carborundum will polish several times the number of square feet of granite that one pound of emery will. Carborundum never case-hardens saws.

THE CARBORUNDUM CO., NIAGARA FALLS, N.Y.

(*Continued from page* 38.)

anticipated work on the 25-ton open hearth steel plant will soon begin. About $65,000 will be spent on the improvements.

Architects Rogers & Macfarlane have prepared plans for a three-story brick addition to the manufactory of the Jenks & Muir Manufacturing Company, on the west side of Hastings street, between Trombley and Milwaukee avenues, Detroit, Mich. It will be 21x73 feet in size, of mill construction.

The Christensen Engineering Company, of Milwaukee, Wis., which is engaged in the manufacture of street car brake equipment, finds it necessary to increase its facilities for handling big contracts. New works are to be built immediately, which on completion will have no less than five times the capacity of the present plants.

The rod mills of the American Steel & Wire Company at Braddock, Pa., formerly controlled by the Pittsburgh Wire Company, are closed for repairs. The works have been run continuously for the past four years. The mills will be equipped with entirely new and improved machinery and with new and larger engines. The capacity will be about doubled.

Architect William Decker has completed plans and specifications for a three story and basement brick and iron mill building for A. Shoenhut & Co., to be located at 2154-2160 Adams street, Philadelphia, Pa., adjoining their present plant. The frame work will be steel, and it will have a slag roof, with latest factory appliances, power apparatus, fire escapes, etc.

The Schuylkill Haven Iron Company, of Philadelphia, Pa., intends erecting an addition to its works at Gray's Ferry road and Thirtieth street from plans which have been recently completed by Architect C. Shuman. The new structure is to be one story high, measuring 80x210 feet, containing special heavy machinery, power apparatus, traveling cranes, etc., and will cost $20,000.

The American Match Machine Company, which was incorporated at Trenton, N. J., Saturday, with $100,000 capital, will establish a factory at Bound Brook, which will turn out a new match-making machine. The daily capacity of the new factory at Bound Brook will be 800 gross of 100 boxes. Already orders have been received for the new machinery that will keep the factory busy until next summer.

Thomas Bohannon and S. H. Egolf, of Philadelphia, Pa., are at the head of a newly formed company that intends erecting a finely equipped paper mill plant at Bristol, Tenn., and another plant of the same description at Buena Vista, Va. The company will be known as the Columbia Paper Company and have a capital of $1,000,000. Ground has been purchased upon which will be erected a factory building of brick and iron.

The William Cramp & Sons Ship & Engine Building Company, of Philadelphia, Pa., will make extensive additions to their plant, and have placed the order with The Berlin Iron Bridge Company, of East Berlin, Conn., for the new buildings. The new machine shop will be 142 feet wide and about 350 feet long; three stories in hight; all the floors, including the gallery floors, to be controlled by electric traveling cranes. The building will be of steel framework, the outside walls of brick.

New Catalogs.

The International Pneumatic Tool Company, Limited, of London, has issued Catalog "G," devoted to the illustration and description of pneumatic tools of various kinds, including drills, hammers, flue cutters, jacks, etc., etc. The catalog is 6x9½ inches.

"Some Day"

you've told yourself, "I'll look up those Portable Tools that Dallett talks so much about, and see how much there is in the claims he makes for them."

"Some day" you may discover that the money you lost while delaying your investigation would have paid for the Portable Tools you need.

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York Street and Sedgley Avenue.

Some Shops

add very materially to their profits by watching the little leaks and devising ways of stopping them.

There's that little matter of oil that's thrown out on chips, bolts, nuts, etc.—thrown out, wasted, when, aside from being discolored, it's practically as good as it ever was.

Some shops that use as little as three barrels of oil per year have bought a Roper Centrifugal Oil Separator and are reclaiming such oil, using it over and over.

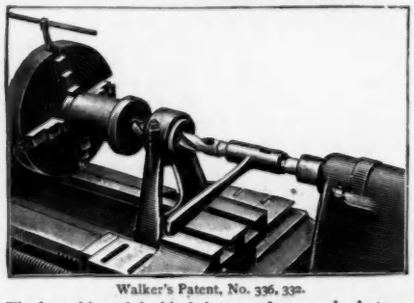
Maybe there's some extra profit for you in this scheme. You can easily find out by addressing the

American Tool & Machine Co.,
Leading Manufacturers of Sugar Machinery,
109 BEACH STREET,
Founded 1845. BOSTON, MASS.
Incorporated 1864.

A SUGGESTION!

Here is something you ought to have around your shop.

Drill & Reamer Holders for Lathe Work.



Walker's Patent, No. 336, 332.

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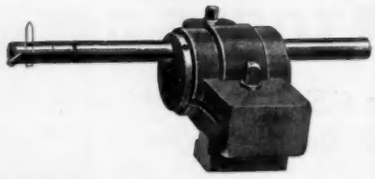

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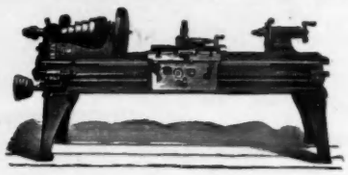

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